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A handwritten signature in cursive script, reading "Angelique C. DeMoncada".

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ABSTRACT

Title of Dissertation: Optimism and Cardiovascular Function in Children with Congenital Heart Disease

Angelique C. DeMoncada, Doctoral Dissertation, 2010

Dissertation Directed By: Willem J. Kop, Ph.D.

Optimism is associated with positive physical and mental health outcomes in healthy adults and in patients with coronary artery disease. Research indicates that attenuated hemodynamic reactivity may contribute to the beneficial health effects of optimism. Little is known about this relationship in children. Congenital heart disease (CHD) affects more than 36,000 infants in the United States every year. This investigation examined whether optimism was correlated with reduced hemodynamic responses; systolic and diastolic blood pressure, (SBP, DBP), heart rate (HR), and heart rate variability (HRV) to acute challenge tasks (mental arithmetic, computer game, mirror trace, and cold pressor).

Participants included 39 children 6-12 years old, and 39 parents (one parent for each child participant). Children completed a series of questionnaires including the Children's Attributional Style Questionnaire and the Behavioral Assessment System for Children self rating scale. The parents also completed a series of questionnaires including the Family Environment Scale and the Behavioral Assessment System for Children parent rating scale. Children then completed a series of 4 5-minute challenge tasks with a 5-minute rest preceding each task. hemodynamic responses were assessed during the rest and challenge tasks.

Mean CASQ score for the full sample was 6.86 ± 4.5 . Results indicated that optimism was related to child distress levels as rated by the parent, but not to self-rated distress levels as rated by the child. Specifically, inverse relationships were confirmed among optimism and Behavioral Symptom Index, parent report ($r = -0.45, p < 0.01$); BASC composite of externalizing behaviors parent report ($r = -0.50, p < 0.01$); and parent-rated anxiety ($r = -0.36, p < 0.01$).

Results partially supported a relationship between optimism and HRV reactivity, but no significant associations between optimism and hemodynamic reactivity were found. Significant correlations with optimism and HRV included Mean NN ($r=0.59, p=.005$) during the mental arithmetic task, in the non-surgical group, while the surgically corrected patients demonstrated a significant relationship between optimism and RMSSD ($r=-0.48, p=.005$) during the mirror trace task.

The data suggest that there may be a relationship between optimism and autonomic nervous system dysregulation. Future research is needed to determine the clinical consequences of the observed relationships.

Optimism and Cardiovascular Function
in Children with Congenital Heart Disease

by

Angelique C. DeMoncada

Dissertation submitted to the faculty of the
Department of Medical and Clinical Psychology
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Figure 1: Theoretical Model Linking Optimism to Cardiovascular Outcome

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Introduction

Behavioral medicine research has increased its emphasis on human strengths and resources over the past 15 years (Chang, 2001). This relatively recent trend adds to the traditional focus on identification and treatment of psychological disorders and adverse health behaviors. The psychological variable of optimism has been associated with positive outcomes in many chronic illnesses (Scheier & Carver, 1992). A growing number of studies demonstrate that optimism is associated with biological processes (e.g. cardiovascular and immune system parameters) and psychological factors (e.g. social support and active coping) that play important roles in the adaptation to medical conditions (Scheier, Matthews, Owens, & Magovern, 1989), including coronary artery disease patients (Engelbreton, Matthews, & Scheier, 1989; Fitzgerald, Tennen, Affleck, & Pransky, 1993; Giltay, Geleijnse, Zitman, Hoekstra, & Schouten, 2004; Giltay, Zitman, & Kromhout, 2006; Helgeson, 2003; Helgeson & Fritz, 1999). These investigations have largely focused on adult populations, which is a common trend in cardiovascular behavioral medicine research. The present study assessed behavioral and cardiovascular correlates of optimism in children with congenital heart defects.

Congenital Heart Disease

Congenital heart disease (CHD) is a chronic illness affecting over 36,000 infants in the United States every year (American Heart Association, 2009). Approximately 70% of infants with CHD grow up to lead productive, active lives

as a result of successful treatment, spontaneous recovery, or the small size of the defects (Garson, 1998). CHD includes a wide variety of structural defects such as atrial septal defect, ventricular septal defect, coarctation of the aorta, and many others. Both physical and psychological difficulties can accompany the diagnosis of CHD even after successful surgical intervention. Children with CHD have increased behavioral problems, increased levels of psychological distress, and increased levels of anxiety compared with healthy children (Gupta, Mitchell, Giuffre, & Crawford, 2001; Oates, Turnbull, Simpson, & Cartmill, 1994; Utens, Verhulst, Erdman, & Meijboom, 1994). Evidence further demonstrates continued compromised cardiac function in most post-surgical children following successful intervention and ongoing CHD treatment. Children with CHD exhibit decreased autonomic nervous system control, decreased heart rate variability (HRV) suggesting attenuated vagal tone, and decreased heart rate response to increased activity levels (Butera et al., 2004; Calkins, 1997; Porges, Matthews, & Pauls, 1992; Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). Little is known regarding the cardiovascular responses to mental challenge tasks that are similar to activities that children with CHD engage in during routine daily life.

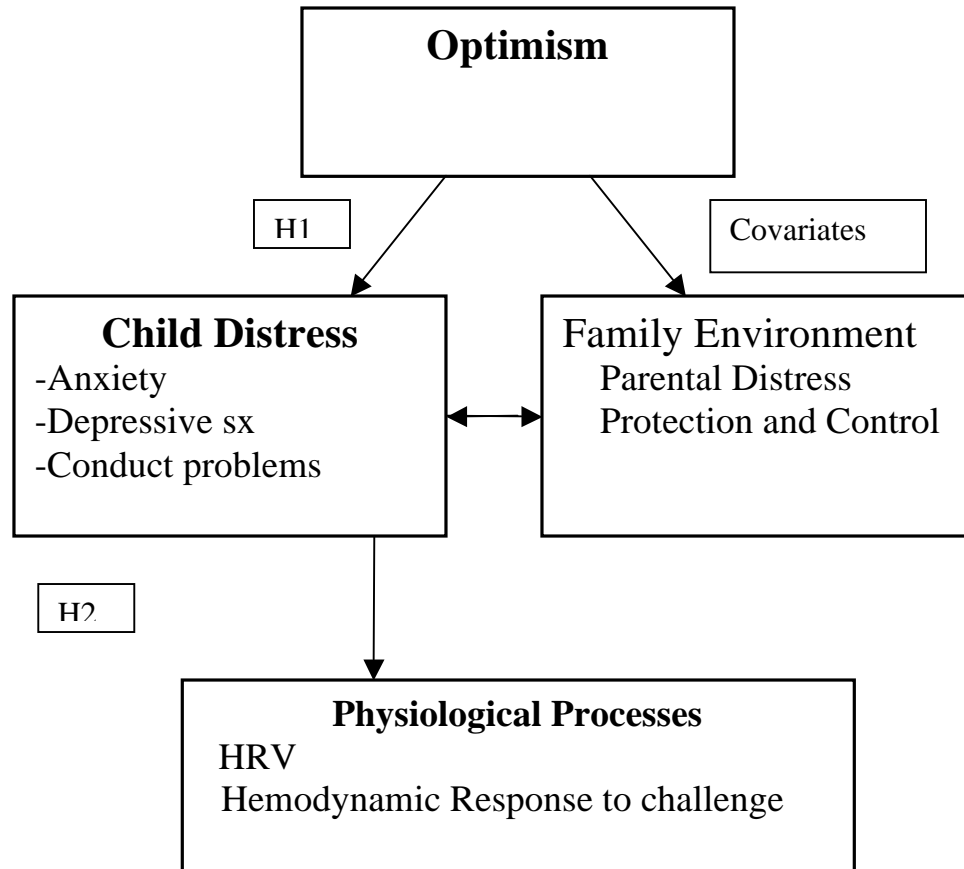
Effects of Optimism in Patients with Congenital Heart Defects

Previous research suggests that the personality trait of optimism predicts hemodynamic responses to environmental challenges in healthy adults and ICD patients (DeMoncada et al., 2005). Therefore, the present study explored whether child optimism levels were associated with cardiovascular function,

particularly heart rate variability, and cardiovascular reactivity to mental challenge in patients with mild uncorrected CHD versus surgically corrected CHD.

Hypothesized biopsychosocial pathways for health benefits related to optimism are illustrated in the conceptual model displayed in Figure 1. In the following paragraphs, biological (i.e. cardiovascular and immune system reactivity to mental challenge), health behaviors (i.e., physical activity levels), and psychological factors (depression, coping style, and family environment), will be discussed, each of which may contribute to hemodynamic and autonomic nervous system dysregulation that can adversely affect the clinical course of CHD.

Figure 1: Theoretical Model Linking Optimism to Cardiovascular Outcome
 (H1, H2 = study hypotheses 1 and 2 respectively)



Background

1. Historical Perspective and Definition of Optimism

The initial discourse on the concept of optimism began in the 17th century (Domino & Conway, 2001) when philosophers debated whether humankind was optimistic or pessimistic in general. The formulation of an “optimistic”

philosophical position can be traced to the writings of French philosopher René Descartes (1596-1650; (Domino et al., 2001). In a departure from the 17th century philosophical perspective, Descartes asserted the existence of a moral sense of optimism and pessimism by his conviction that human beings are fully capable of improving the state of the world. However, in the early 18th century Voltaire (1694-1778) refuted the necessity of either an optimistic or pessimistic philosophical outlook because these constructs could be conceived as needless if reason is properly applied and confirmed empirically. David Hume's (1711-1776) position was similar to Voltaire's, arguing that applying reason to the cosmos leads to skepticism rather than optimism or pessimism (Domino et al., 2001). Thus, no strong consensus existed for either the optimistic or the pessimistic nature of humankind until the end of the 19th century when optimism and pessimism started to be discussed in terms of a psychological trait.

Founding scholars in psychology and related disciplines incorporated optimistic or pessimistic views of human nature into their theories. For example, Sigmund Freud (1856-1939) included references to both optimism and pessimism in his theory of human nature and development. He asserted that humans have a drive towards pleasure (Eros), and death (Thanatos). The drive towards pleasure and happiness represents the optimistic side of human nature and the drive towards death represents the pessimistic aspect of human nature (Freud, 1927/1961, p. 8). The psychologist William James (1842-1910), was the first to consider optimism and pessimism as applied to individual traits rather than humankind collectively. James considered the metaphysical debate of optimism

and pessimism as irresolvable, and instead postulated that the disposition of optimism and pessimism lies within the individual. The position that optimism and pessimism are individual personality traits has ultimately lead to empirical study and measurement of optimism as a psychological construct.

The impact of concepts related to optimism on health has been systematically explored and supported by a wide range of research, primarily focused on chronic illness. Dispositional optimism is the most widely used and researched conceptualization of optimism (Chang, 2001). Dispositional optimism is defined as a relatively stable, generalized expectation that good outcomes will occur across important life domains (Scheier & Carver, 1985). This definition implies that people maintain a relatively constant level of optimism over time and across different situations. This approach allows for some temporary variability in optimism levels based on current environmental or intra-personal circumstances. The disposition is nonetheless a general tendency to consistently expect positive outcomes (Scheier et al., 1985).

Another approach defines optimism by an individual's use of attributional styles. Attributional styles refer to characteristic ways in which people routinely explain the events in their lives (Seligman, 1984). Internal attributions refer to the tendency to see causes of events as resulting from the individual rather than forces beyond the individual's control. Stable attributions refer to the tendency to see causes of events as stable over time versus temporary. Global attributions refer to the tendency to see causes of events as a consequence of factors that affect multiple events and that are not specific to a single event (Seligman,

1984). An individual with an optimistic attributional style would explain the source of negative life events as resulting from external, temporary, and specific causes for the circumstances are postulated, whereas positive events are attributed to internal, stable, and global causes. The pattern is purportedly reversed in pessimistic individuals, such that pessimists tend to attribute negative events to internal, stable, and global causes, and explain positive events as the result of external, temporary, and specific events. One of the consequences of these different attributional styles is related to helplessness, i.e., the feeling that nothing an individual does will influence the outcomes of a particular situation and subsequent depression (Seligman, 1984). Consequently, it is suggested that optimistic explanatory styles will reduce the experience of helplessness thereby reducing the likelihood of depression; whereas a pessimistic explanatory style will increase the experience of helplessness and the likelihood of depression (Seligman, 1984).

Unrealistic Optimism

Although dispositional optimism and attributional style are the most commonly used conceptualizations of optimism, an additional important dimension of optimism entails “unrealistic optimism” or “optimistic bias.” Weinstein (1980) reports evidence that people believe that negative events are less likely to happen to them than to their peers. This type of optimism is called unrealistic because, on average, participants rate their own risks as ‘below average’ therefore unrealistically underestimating actual risks. Unrealistic optimism can be both functional and dysfunctional. Unrealistic optimism may

increase self esteem, and coping ability, but alternatively, the illusion of invulnerability may hinder the prevention of negative events (Peeters, Cammaert, & Czapinski, 1997) and potentially reduce the likelihood of changing adverse health behaviors. Therefore unrealistic optimism is expected to adversely affect health outcomes.

Personality characteristics are generally considered to be stable traits rather than momentary states of the individual. Traits are defined as enduring dispositions, which means that they are distinguishable from transient moods and situational influences (Thomas, Segal, & Hersen, 2006). Traits are characteristics of the individual and show continuity, but this does not mean that they can't fluctuate. Physical traits provide a useful analogy. Height is a property of the individual, not a reflection of the current situation. Height, however, increases through childhood and adolescence as a result of development, and declines again in old age (Friedlander et al., 1977). Height can also be affected by diseases or pharmacological interventions. The same assertions are true of personality traits, enduring traits can change, either through intrinsic development, or through external interventions (Pervin, 2002). Additional discussion of the development and determinants of optimism will be provided below.

There has been debate over whether optimism and pessimism comprise two extremes of the same psychological dimension, or whether these constructs are inversely related but not necessarily opposites. Hummer & Dember (1995) argue that optimism and pessimism may not be extensions of the same trait but

rather are separate, albeit related, constructs. The authors developed a 56 item Optimism/Pessimism Scale which assesses level of optimism and level of pessimism as potentially separate dimensions. Scores on this scale suggest that individuals can be classified into one of four possible categories: (1) optimists - high optimism/low pessimism; (2) defensive pessimists - high optimism/high pessimism; (3) genuine pessimists - low optimism/ high pessimism; and (4) undifferentiated - low optimism/low pessimism. The authors reported a subset of individuals who score both high on optimism and high on pessimism (category 2, defensive pessimists), indicating that optimism and pessimism are not necessarily polar opposites. However, tests conducted to determine the extent by which the defensive pessimist group differed from the optimist and genuine pessimist groups on other measures such as the BDI, indicated that individuals in the defensive pessimism category scored between the optimists and genuine pessimists. These findings suggest that the optimism-pessimism polarity probably reflects a one-dimensional construct, which is consistent with the conceptualization by Scheier and Carver (1985).

II. Measurement of Optimism

Attributional Style Questionnaire

The Attributional Style Questionnaire (ASQ) has been developed to measure optimistic attributional style in adolescents over age 13, and adults (Peterson & Villanova, 1988). The ASQ consists of 6 positive and 6 negative

event items. For each event, respondents write down one major cause for why that event occurred, and provide ratings across scales that assess internality, stability, and globality. To improve the reliability of the ASQ scales an Expanded Attributional Style Questionnaire (EASQ) was developed (Peterson et al., 1988) by removing the positive event items and adding 18 negative event items. The level of optimism and pessimism can be inferred by the specific pattern of attributions. Attributional measures therefore provide an indirect assessment of dispositional optimism and pessimism.

A child version has also been developed to measure optimistic attributional style in pediatric samples (Kaslow, Tannenbaum, & Seligman, 1978). The Children's Attributional Style Questionnaire (CASQ), is a 48-item, forced choice, self report questionnaire (see Appendix A). Each item on the CASQ includes a sentence describing a good or an adverse event, such as, "You get an A on a test," and two phrases describing possible causes of that event, such as "because I am smart." or "because I am good at the subject the test was in." Children are asked to imagine the event happening to them and to check which of the two causes describes why that event happened. The CASQ includes 24 positive events and 24 negative events related to school and sports achievement, peer relationships, and relationships with parents. Scores range from -24 to +24 with higher scores reflecting more optimistic explanatory style. This inventory has been extensively used in pediatric studies with an average overall CASQ score of 6.24 ± 3.02 and has demonstrated satisfactory reliability (Cronbach's $\alpha = 0.54 - 0.73$; (Seligman, 1984).

Life Orientation Test

The Life Orientation Test (LOT; (Scheier et al., 1985) is the most commonly used measure of dispositional optimism in adult populations. Because expectancies are directly related to behavior, Scheier & Caver (1985) have proposed that a direct measure of expectancies would result in a more accurate prediction of behavior. Scheier & Carver acknowledged that attributions affect expectations; however they stated that attributions were only one determinant of expectancies. To measure life expectancies directly, these investigators developed the LOT (Scheier et al., 1985). The LOT is an 8-item measure (plus 4 filler items) of individual difference in dispositional optimism. Four of the items are phrased positively and four negatively. The LOT also includes four filler items to mask the underlying purpose of the inventory, and control for individual response tendencies. Respondents indicate to what extent they agree with each of the items using a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The total score ranges from 0-32 with higher scores indicating higher levels of optimism. The high 4-week, test-retest reliability correlation ($r = .79$) suggests that that optimism may be a relatively stable trait over time (Scheier et al., 1985).

The LOT demonstrates convergent validity with comparable psychological traits. Specifically, optimistic individuals score higher on measures of self esteem ($r=.48$, $p<.01$) and internal locus of control ($r = .34$, $p<.01$). Although these correlations are of moderate magnitude, they are not so strong as to negate the independence of optimism as a distinct construct. Similarly,

evaluations of divergent validity have yielded results in the expected direction. Optimistic individuals score lower on measures of perceived stress, ($r = -.55$, $p < .01$), depression ($r = -.49$, $p < .01$), hopelessness ($r = -.47$, $p < .01$), and powerlessness ($r = -.40$, $p < .01$; (Scheier et al., 1985). The LOT was revised in 1994 to minimize overlap of item content with other constructs, specifically coping style (Scheier, Carver, & Bridges, 1994). The LOT-R contains 6 items (plus 4 filler items). The test-retest reliability of the LOT-R is satisfactory ($r = .68$ at four months, $r = .60$ at 12 months, $r = .56$ at 24 months, and $r = .79$ at 28 months). Analyses of convergent and divergent validity of the LOT-R reveal that optimism is significantly related to lower depression levels. Factor analysis has also shown that optimism can be considered as a separate construct from self-mastery, self-esteem, and neuroticism (Scheier et al., 1994).

A Youth version of the LOT (the YLOT) has been developed for administration in school aged children and a child version of the LOT is in development for use in pre-school children (Ey, et al., 2005). This measure is a 12 item 4 point likert scale (with two filler items). This inventory has an average overall score of 24.85 ± 5.87 and has demonstrated satisfactory reliability (Cronbach's $\alpha = 0.83$ for children grades 3 – 6 (Ey et al. 2005). Currently these measures have not been validated for use in children of other grade levels or in children with chronic diseases. Because of the lack of validation of the YLOT, optimism will be defined and assessed as attributional style, and measured with the CASQ consistent with the aforementioned definition formulated by Seligman et al. (1984).

Correspondence between the LOT and the ASQ

Few studies have assessed optimism using both the LOT and ASQ. Chang (2001), reports that the magnitude of overlap between the two measures has been inconsistent in adults, with correlations ranging from .20 to .77. Although both the LOT and ASQ are associated with many of the same outcomes (i.e. decreased depression and health benefits), these findings may reflect the differences in the theoretical models underlying each measure and the item construction of the questionnaires. The LOT measures expectancy of both positive and negative events and is future oriented, whereas the ASQ measures causal attributions of past events. The current study focused on predicting cardiovascular responses in children. Because the YLOT has not yet been validated for use in children of certain ages, the CASQ was used to address the research questions of the present investigation.

III. Determinants and Development of Optimism

Evidence suggests that personality characteristics are considerably stable over time. It is difficult, however, to measure changes in personality characteristics from childhood to adulthood because of the challenge of using comparable psychological measures across the life span. Block (1971) conducted a longitudinal study measuring personality characteristics of participants while they were in junior high school, senior high school and in their thirties. The development of personality over time revealed significant

correlations between the personality ratings made at these three different time points. He found that the average across-time correlations of overall personality measures were .76 for junior high to senior high school ratings, .28 for senior high school to adulthood ratings, and .22 for junior high school to adulthood (Block, 1971; Block, 1993).

In subsequent research Block & Block, (1980) measured personality characteristics in 128 individuals at 8 assessment periods between the ages of 3 and 23: at ages 3, 4, 5, 7, 11, 14, 18, and 23. The average correlation between two time periods was .48 demonstrating the coherence of early character structure for later character structure (Block, 1993). Caspi (2000) conducted a large study on changes occurring between the ages of 3 and 21 and the influence of early appearing temperament differences for life-course development. Children at age 3 were categorized by Thomas and Chess's (1977) patterns of temperament: the well-adjusted type, the undercontrolled type, and the inhibited type. Subsequent testing at age 18 revealed consistent patterns of personality characteristics on the Multidimensional Personality Questionnaire for each of the 3 temperament styles. These results suggest that there is continuity of temperament throughout childhood into personality in adulthood (Caspi, 2000). Stroufe reports similar findings in studies of early infant attachment style (Ainsworth & Bowlby, 1991) and consistent personality development through adolescence suggesting that while change occurs, coherence between infant patterns and later patterns of behavior exists (Stroufe, Carlson, & Shulman, 1993). These results demonstrate that although there is

potential for change across time in personality development, early patterns do modestly influence personality characteristics in adulthood (Pervin, 2002). Heinonen and colleagues (2005) conducted a study on the development of optimism over a 21 year period. The authors found that early-life characteristics of a difficult temperament (defined by Thomas & Chess (1977) as more emotional, irritable and fussy, crying a lot, and have more irregular eating and sleeping patterns) assessed at ages 3-6 did not predict optimism later in life. In contrast, later measures of difficult temperament assessed at ages 6-9 did predict level of optimism in adults. Further, they found no gender differences in optimism scores (Heinonen, Raikkonen, & Keltikangas-Jarvinen, 2005).

Other research suggests that developmental continuity may be more strongly related to the continuity of the individual's environment or situational consistency (Lewis, Dember, Schefft, & Radenhausen, 1995). Little research has been conducted to demonstrate the stability of specific personality characteristics (e.g. optimism) from childhood to adulthood. Therefore relationships found between optimism and cardiovascular reactivity in childhood may or may not endure across the life-span; this question is beyond the scope of the current study and the focus of the present investigation was on the relationship between optimism and CV responses to mental and physical challenge in children.

Development of Optimism

Extensive evidence suggests the numerous health benefits of optimism (Antoni & Goodkin, 1988; Carver & Gaines, 1987; Carver, Pozo, Harris, &

Noriega, 1993; Reker & Wong, 1984; Scheier et al., 1985), but little is known about the factors related to the development of optimism. Both genetic and environmental components have been identified as contributing to an individuals' level of optimism. A study by Plomin et al. (1992) examined the etiology of optimism and the biological and genetic component of individual differences. These investigators found that approximately 23% of the individual difference in dispositional optimism could be attributed to genetic heritability. The authors also suggested that environmental factors resulting from shared environment play some part in the development of optimism. Furthermore, they suggest that optimism is an acquired (learned) trait regardless of genetic predisposition. Scheier & Carver (1993) propose that optimism is learned, as well as Seligman who titled one of his books *Learned Optimism* (1990). In both instances, the development of optimism is believed to have strong roots in family environment and experiences with success and failure.

The perception of family functioning is important in the exploration of the development of optimism. One exploratory study (Mcsteen, 1997) indicated that individuals who perceived their family as being adaptive and cohesive scored higher on the measure of optimism.

McSteen (1997) found that there were significant correlations between the LOT-R and several subscales of the Family Environment Scale (FES) in college students. The FES consists of 10 subscales: Control, organization, moral-religious emphasis, active-recreational orientation, intellectual-cultural emphasis, achievement orientation, independence, conflict, expressiveness, and cohesion.

Of these subscales, the following seven were positively correlated with the LOT-R: Moral-religious emphasis ($r=.14$, $p<0.01$), active-recreational orientation ($r=.19$, $p<0.01$), intellectual-cultural emphasis ($r=.26$, $p<0.01$), conflict ($r=-.32$, $p<0.01$), expressiveness ($r=.20$, $p<0.01$), organization ($r=.18$, $p<0.01$), and cohesion ($r=.34$, $p<0.01$). The present study therefore evaluates the role of the family environment in the psychological and biobehavioral correlates of optimism.

IV. Health Consequences of Optimism

A relatively large body of literature indicates that dispositional optimism contributes to health outcomes in a number of chronic illnesses. In adult populations, positive health outcomes have been demonstrated in patients with early stage breast cancer (Carver et al., 1993), multiple sclerosis (Barnwell & Kavanagh, 1997), diabetes mellitus (Kavanagh, Gooley, & Wilson, 1993), and rheumatoid arthritis (Brenner, Melamed, & Panush, 1994). Additionally, Schultz and colleagues (1996) have reported that the presence of pessimism is a strong predictor of mortality in cancer patients (Shultz et al., 1996). Research in children has demonstrated that optimism is associated with increased adherence to prescribed medical regimen, reduced behavioral problems, decreased depression, decreased distress, and increased quality of life (van Rijen et al., 2005; van, Geenen, Kuis, Heijnen, & Sinnema, 2001).

Optimism and Coronary Artery Disease

Several studies have examined whether optimism is a protective factor in coronary artery disease (CAD) progression. In two studies Scheier and colleagues (1989, 1999) investigated the effects of optimism on recovery from coronary artery bypass graft (CABG) surgery. After controlling for extensiveness of patients' surgery, severity of underlying CAD, and major CAD risk factors, optimism predicted improved recovery in both studies. Scheier et al. (1989, 1999) also found that optimistic individuals had fewer perioperative myocardial infarctions (MI; $F(1, 46) = 7.82, p < .01$), demonstrated more rapid recovery during hospitalization ($F(1, 44) = 6.67, p < .02$), had a faster return to normal daily routine ($F(1, 42) = 6.92, p < .02$), took a more active role in the recovery process ($F(1, 45) = 10.18, p < .005$), and reported greater life satisfaction 6 months following surgery ($F(1, 43) = 34.16, p < .0001$; Scheier et al. 1999). Results further revealed that all-cause rehospitalization was lower among optimistic than pessimistic individuals, including post surgical sternal wound infection, angina, MI, referral for angioplasty, and necessity for repeat bypass surgery ($N=247, b=-.09 \pm .04, p < .05$; odds ratio = .77, 95% confidence interval = 0.57 – 1.05). These effects of optimism were independent of self-esteem, depression, and socioeconomic status (Scheier et al., 1999).

In a study investigating long-term disease progression and psychological adjustment among angioplasty patients optimism contributed to positive health outcomes (Helgeson, 1999). Optimism, combined with self-esteem, and locus of control were assessed and calculated into a Cognitive Adaptation Theory Index (CATI). Higher CATI scores predicted fewer cardiac events, better mental

health, higher levels of vitality, more positive health perceptions, and higher quality of life. These results were observed at both the 6-month and 4-year follow up (Helgeson, 2003b; Helgeson et al., 1999).

Additional studies have further demonstrated positive effects of an individual's explanatory style (referred to as optimism) in CAD patients. Kubzansky and colleagues (2001) assessed optimistic explanatory style using the Optimism-Pessimism Scale (Malinchoc, Offord, & Colligan, 1995) in the Normative Aging Study, and found a protective dose-response relationship between higher levels of optimism and reduced occurrence of nonfatal MI [present risk], angina pectoris (relative risk 0.45, 95% confidence interval = 0.29 - 0.68), and fatal cardiac events (relative risk of 0.44, 95% confidence interval = 0.26 - 0.74) during 10 year follow-up. Shnek and colleagues (2001) established that optimism levels predicted depression in hospitalized patients with ischemic heart disease at 1 month and 1 year post discharge, whereas self efficacy measures did not. Finally, Mahler and Kulik (2002) have confirmed that high optimism is associated with less pain early during recovery from coronary bypass surgery. All but the most pessimistic patients reached comparable pain levels by the 12 month follow up. These studies demonstrate that optimism positively relates to health outcomes in a variety of medical disorders, including coronary artery disease among adults. The present study explored the biobehavioral correlates of optimism in children with a range of congenital heart defects.

V. Pathogenesis of Congenital Heart Disease

Congenital heart disease is by definition present since birth. CHD consists of a number of defects in the cardiac structure primarily resulting in left-to-right shunting of blood away from systemic circulation and towards the pulmonary circulation. CHD may affect various heart structures, such as the valves, the veins leading to the heart, the arteries leaving the heart or the connections among these various parts of the cardiac muscle. Congenital heart disease was once a major cause of infant mortality and is now survived into adulthood by 60-85% of patients (Doroshov, 2001), approximately 90% of whom have minor residual symptoms following successful treatment (either surgical or pharmacological interventions). Although this is a heterogeneous diagnostic group, patients with CHD share many features. Children with ventricular septal defects (VSD), atrial septal defects (ASD), patent ductus arteriosus (PDA), pulmonary stenosis, aortic stenosis, mitral valve prolapse, or surgically repaired ASD, VSD, PDA, tetralogy of Fallot, or coarctation typically have good to excellent hemodynamics and few residual symptoms. Long-term risk for these patients appears to be low (Doroshov, 2001). However some patients continue to experience pulmonary insufficiency, or left to right shunting that may cause residual symptoms such as exercise intolerance. Some of the more common congenital heart defects that are included in the present study include atrial and ventricular septal defects, atrioventricular septal defects, tetralogy of Fallot, coarctation of the aorta, and Ebstein's anomaly. These are discussed below.

a. Atrial Septal Defects and Ventricular Septal Defects

Atrial septal defects (ASD) are characterized by incomplete closure between the two upper chambers of the heart. Blood can therefore flow through a hole in the septum between the upper chambers causing one or both heart chambers to pump extra blood. Ventricular septal defects (VSD) are very similar to atrial septal defects. In this case, the defect is in the heart muscle forming the septum between the ventricles, with generally more severe symptomatic consequences than observed in ASD.

In cases of ASD and VSD, the heart commonly dilates and the cardiac muscle can become weak resulting in reduced cardiac output. Furthermore, pulmonary artery pressures can increase (pulmonary hypertension) due to the increase in blood flow. In ASD and VSD blood flows mainly from the higher pressure left side to the right, although some blood flows in the reverse direction. The defects may be of different sizes, and some may be associated with other abnormalities. Both of these factors determine whether and what type of surgery may be necessary. If the defect closes on its own or with the aid of surgery, these hemodynamic consequences can be avoided.

If a substantial size defect is not corrected, then the pressures in the pulmonary arteries may become very high and induce changes in the arteries themselves such that even closure of the defect will no longer improve the patient. In this case, the pressures in the right side of the heart are high enough

that blood may begin to flow from the right to the left side of the heart. This situation is called "Eisenmenger's syndrome", a condition which may result from several similar abnormalities (see below).

Atrioventricular septal defect (AVSD) is a more severe occurrence of the above mentioned defects. AVSDs can cause a number of complications. The symptoms are similar to the symptoms of heart failure as the heart fails to adequately supply the body with oxygenated blood. Other complications include an enlarged heart and high blood pressure in the lungs. It may also result in heart failure. Surgery is always necessary to treat an AVSD. Because of increased understanding of heart valve anatomy and better imaging techniques, the outcome of surgery is usually excellent.

b. Eisenmenger syndrome

Eisenmenger syndrome is a complex syndrome that begins with congenital heart defect. Although it can sometimes be detected in newborns, it frequently does not cause any symptoms until adulthood. Eisenmenger syndrome is the result of one or more specific congenital defects that cause pulmonary hypertension or high blood pressure in the lungs, leading to a lack of oxygen-rich blood reaching the tissues of the body.

c. Coarctation of the Aorta

Coarctation refers to narrowing of the aorta, typically located just after the vessels branch out to the left arm. Coarctation of the aorta causes high blood pressure because the kidneys do not receive blood at the pressure required. Physiological responses to raise blood pressure influence circulation prior to reaching the blockage causing high blood pressure in the heart and brain, but not in the lower portions of the body.

Coarctations generally require surgical repair. Dilating the segment with a balloon is a possibility, particularly in the young. Surgical removal of the narrowed segment may need to be accomplished in selected patients. If aortic coarctation remains untreated the high blood pressure which is induced may become permanent even after removal of the segment as a consequence of irreversible changes in several end organs. Other cardiovascular abnormalities may co-exist, particularly abnormalities of the aortic valve. Coarctation of the aorta is quite common, accounting for about 15-20% of cases of congenital heart disease, and is more common in males than in females (O'Sullivan, 2002).

Further, studies have shown that abnormally high systolic blood pressure commonly occur with exercise even in patients who are normotensive at rest following coarctation repair as well as Fontan repair, who are otherwise asymptomatic (Gewillig, 2005; Hauser, 2003);. This is of potential concern because blood pressure (reactivity as well as resting levels) are independent risk factors for cardiovascular morbidity and mortality in adults (Levy, 1990; Muller, 1994).

d. Tetralogy of Fallot

Four abnormalities characterize this fairly common condition: 1. presence of a ventricular septal defect, 2. narrowing of the pulmonary valve (i.e. pulmonary stenosis), 3. the aorta "overrides" the ventricular septal defect, and 4. thickening (hypertrophy) of the right ventricle. As a result, decreased flow of blood to the lungs is a characteristic feature of tetralogy of Fallot, as is mixing of the blood from each side of the heart. Despite its complexity, tetralogy of Fallot is quite common and can often be completely repaired.

e. Ebstein's Anomaly

The primary abnormality in Ebstein's Anomaly is of the tricuspid valve (the valve which lies between the right atrium and right ventricle). While there is free flow of blood forward across the tricuspid valve to the right ventricle, the deformed tricuspid valve allows a large amount of blood to flow backwards from the right ventricle to right atrium (regurgitation) when the right ventricle contracts. The treatment of this disorder depends on whether or not the patient is symptomatic. Surgery is sometimes required early in life and may result in normal life expectancy. Irregular and fast heartbeats (i.e. arrhythmias) frequently accompany this condition.

VI. Biopsychosocial Consequences of CHD

The physiological characteristics of children with CHD include impaired exercise tolerance and altered autonomic nervous system (ANS) activity as measured by heart rate variability (Finley, Nugent, Hellenbrand, Craig, & Gillis, 1989; Massin & von Bernuth, 1998a; Massin, Derkenne, & von Bernuth, 1998b). In addition to the physiological aspects of CHD, the diagnosis of this chronic illness can cause distress in the child, parents, and family (Boll, Dimino, & Mattsson, 1978; Goldberg, Simmons, Newman, Campbell, & Fowler, 1991; Lavigne & Ryan, 1979; Lawoko & Soares, 2002; Pelchat et al., 1999; Tak & McCubbin, 2002). Parental reactions to the illness are often reflected in the child's emotional adjustment to CHD and CHD may disrupt interactions and relationships within the family (DeMaso, Campis, Wypij, & Bertram, 1991; Gardner, Freeman, Black, & Angelini, 1996; Goldberg et al., 1991; Gupta et al., 2001). These disturbed relationships combined with the physical concomitants of the disease itself may affect the child's personality development and behavioral characteristics. Further, although coronary artery disease is rare in children with congenital heart defects, they are at higher risk of developing cardiovascular disease as adults. Therefore underlying CHD increases the importance of reducing the risk factors for CAD later (Doroshov, 2001).

Extensive studies have addressed the psychosocial function of children with CHD. Most studies demonstrate psychological differences between CHD patients and healthy controls. Brandhagen et al. (1991) found that adults with

simple or corrected CHD scored significantly higher than controls on measures of obsessive-compulsive tendencies, depression, and a general severity index of psychological dysfunction (Brandhagen, Feldt, & Williams, 1991). Garson et al., (1998) reported that adolescents who had undergone corrective surgery for CHD were more likely to be neurotic (Garson, 1998). Utens et al. (1993) documented that children and adolescents with simple corrected CHD reported more emotional problems as measured by the total problem score on the Child Behavior Check List (CBCL) than healthy children (Utens, Verhulst, Meijboom, & Duivenvoorden, 1993).

The determinants of psychophysiological consequences of CHD are not well understood. Among healthy children, the family environment as well as the child's personality characteristics, are related to the child's ANS responses to external challenges, such as exercise and mental tasks (Sallis, Dimsdale, & Caine, 1988; Treiber, Musante, Riley, & Mabe, 1989; Vogeley & Steptoe, 1993; Wright, Treiber, Davis, & Strong, 1993). It is not known to what extent altered ANS function in CHD reflects the biobehavioral correlates of maladaptive child characteristics or dysfunctional family environment, as has been demonstrated to affect ANS function in healthy children. Furthermore, because little is known about how the level of disease severity may impact the pathways by which optimism affects health outcomes the present investigation examined the associations of optimism with cardiovascular measures (blood pressure, heart rate and HRV) in patients who have required previous surgical interventions as well as those who had not required such interventions.

VII. Autonomic Nervous System Activity in Children with CHD

One of the physiological characteristics associated with CHD is suppressed heart rate variability (HRV). Heart rate variability is used as an indicator of autonomic nervous system activity and also used as a measure of an individual's ability to adequately respond to the environment (Porges, 1992b; Porges, Matthews, & Pauls, 1992b). Within a normal range, the greater the physiological variability an individual expresses (i.e. HRV), the greater the response potential or possible range of adaptive behaviors (Porges, Matthews, & Pauls, 1992a). Measures of HRV have been associated with heart rate reactivity and predict future adverse cardiovascular outcomes, such as ventricular tachycardia and postinfarction mortality, in CHD patients, healthy children, and adult patients with cardiovascular disease (Butera et al., 2004; Malik et al., 1996; Martin et al., 1987; Porges, 1992a).

There are two major methods of measuring heart rate variability, time and frequency domain analysis. Mean time between normal heart beats, the mean HR, and differences between the longest and shortest inter-beat-interval can be calculated and used as measures of heart rate variability. Time domains are statistically the simplest to perform.

The second commonly used method examines the frequency domain of HRV. These are calculated using spectral analyses. Power spectral density (PSD) indicates how power distributes as a function of frequency. The three

main spectral components of HRV are high frequency power (HF, 0.15-0.40 Hz), low frequency power (LF, 0.040-0.15 Hz), and very low frequency power (VLF, 0.0033-0.040 Hz). HF represents the parasympathetic control of the heart (Malik et al., 1996), whereas LF represents both sympathetic and parasympathetic activity. Therefore, HF can be used as an index of parasympathetic (vagal) activity. These ANS measures have been used to examine the flexibility of cardiac response during rest and challenge conditions in the laboratory. In the present study, all assessments of ANS activity occurred while the children were in the laboratory, and the Holters were removed upon completion of the challenge tasks.

Numerous studies have assessed the possible behavioral correlates of HRV in healthy children. Both Kagan et al. (1989) and Calkins and Fox (1992) examined the possible association between behavioral inhibition, an aspect of sociability and shyness, with HRV-based measures of vagal tone. Both studies found no relationships between measures of HRV and measures of behavioral inhibition. However, Calkins and Fox found that infants who cried at both a pacifier withdrawal and at the presentation of a novel stimulus exhibited significantly higher vagal tone than children who did not cry at either event. Similarly, Gunnar et al. (1995) found that infants who exhibited higher levels of distress, more behavioral reactivity, and higher levels of cortisol during a heel stick procedure displayed significantly higher levels of baseline vagal tone. These findings suggest that vagal tone may reflect reactions to frustrating or novel stimuli as early as infancy.

Calkins (1997) studied suppression of vagal tone during positive and negative affect elicitors, such as a game of peek-a-boo and the removal of a desired toy, in 2 to 3 year-old children. Greater suppression of vagal tone during the events was significantly correlated with higher positive behavioral reactivity and lower levels of negative reactivity. Greater vagal tone suppression was also related to looking and talking to the experimenter during the negative tasks. On the other hand, children who are unable to adequately regulate or suppress vagal tone during social and attention tasks in infancy display a significantly higher rate of behavior problems at 3 years of age (Porges et al., 1996). These results indicate that suppression of vagal tone may be associated with behavioral regulation during emotionally salient activities as well as behavioral problems later in life.

Research with school-aged children has also demonstrated that HRV is associated with responses to situations involving other children or infants in distress. Specifically, Fabes, Eisenburg, and Eisenbud (1993) analyzed third and sixth graders' HRV and behavioral responses to a film depicting two children concerned and upset about a stranger approaching their house. For boys, higher HRV was associated with greater expression of facial concerned attention and decreased likelihood of becoming highly aroused, as measured by skin conductance. For girls, HRV was positively associated with dispositional sympathy and negatively associated with self-reports of distress and facial expressions of distress. In a similar study, Fabes et al. (1994) presented kindergarten and second grade children with the sounds of an infant crying over

an intercom. The children were told that they could talk to and soothe the infant and that they were able to turn off the intercom. Both boys and girls with higher HRV displayed more problem solving and coping responses, such as talking to the infant in a comforting manner, and fewer aggressive or avoidant responses, such as turning off the intercom. Mothers of children with higher HRV were also more likely to report that their child used more constructive coping strategies and fewer aggressive or avoidant strategies when confronted with others in distress. This research provides evidence that physiological regulation, as assessed by HRV and vagal tone, may influence emotional and behavioral responses to an individual's environment.

These findings are of particular importance with regard to CHD because children with unoperated septal defects have significantly lower HRV than healthy controls (Finley et al., 1989; Kul & Su, 1997; Kupari, Virolainen, & Ventila, 1992; Massin et al., 1998a; Massin et al., 1998b). After surgery, the HRV of children with CHD typically increases to levels similar to normal children. In terms of the severity of the illness, Massin and von Bernuth (1998) found children with the lowest level of severity (functional class I) were not different from healthy controls in HRV, whereas HRV was progressively depressed in children in functional classes II-IV. These findings indicate that children with CHD may have abnormal or deficient cardiac autonomic control, which could be further affected by behavioral and emotional distress.

No research to date has studied the inter-relationship between physiological dysregulation including HRV-based markers of ANS function and

children's behavioral responses to "usual" (i.e., commonly occurring in daily life) mental and physical activities. Both ANS measures at rest as well as ANS increases in response to exogenous challenges, such as cold, exercise, and mental tasks are associated with adverse cardiovascular risk in adults (Keys et al., 1971; Krantz et al., 1999; Treiber et al., 2003).

It is known that elevated ANS reactivity is associated with the development of future cardiovascular disease, including hypertension and coronary heart disease (Matthews et al., 2004; Sallis et al., 1988). Therefore, the cardiovascular responses of children in this potentially high-risk group may have important clinical implications. Blood pressure (BP) reactivity in childhood predicts future development of hypertension, left ventricular hypertrophy, and possibly other cardiovascular endpoints, but the specific characteristics that affect BP reactivity in children are not well understood (Allen, Matthews, & Sherman, 1997; McGrath & O'Brien, 2001). Therefore, the present study examined the relative importance of CHD status, optimism, and child distress as predictors of HRV-based ANS function in children with CHD.

According to a systematic literature review by Sallis et al. (1988), many of the earlier studies in the field found that anxiety, anger, and hostility are related to BP reactivity in children. Vogeleson & Steptoe (1993) found that high levels of anger inhibition and trait anxiety interacted with family risk for hypertension to produce elevated BP reactivity to laboratory stressors in adolescent boys. Boys at higher risk for hypertension, with the highest levels of trait anxiety and the highest levels of anger inhibition, demonstrated the most reactivity to each of the

laboratory stressors, whereas, anger out was not related to responses to challenges.

Treiber et al. (1989) reported that expressive hostility is related to blood pressure in 7-10 year old children. Children who outwardly expressed more feelings of anger and negative affect demonstrated higher levels of resting blood pressure. Children exhibiting higher levels of resentful and suspicious attitudes towards others (i.e. experienced hostility) displayed lower resting systolic blood pressure. Both the Vogele and Steptoe (1993) and the Treiber et al. (1989) studies demonstrate that different aspects of hostility and anger may affect resting BP and cardiovascular reactivity (CVR). However, whether or not the same correlations between optimism, and CVR exist in children with CHD is not known. The current study investigates whether optimism of children with CHD was related to measures of HRV and blood pressure reactivity.

VIII. Biopsychosocial Pathways Accounting for the Cardiovascular Benefits of Optimism

There are a number of possible pathways through which optimism may provide cardiovascular benefits in children with CHD. Optimism may influence pathogenesis of cardiovascular disease and subsequent cardiac events biologically by decreasing cardiovascular reactivity to exogenous mental challenges, or by increasing the effectiveness of immune system responsiveness to various pathogenic challenges. Further, optimistic individuals may be more

inclined to engage in positive health behaviors than pessimistic individuals, thereby increasing cardiovascular health and may more consistently adhere to the prescribed medical regimen. Psychological factors associated with optimism such as decreased depression, increased social support, and coping style may also be responsible for cardiovascular outcomes. The following sections explore how each of these constructs relates to optimism and how they may be associated with cardiovascular benefits.

a. Biological Factors Related to Optimism

Cardiovascular Reactivity to Mental Stress

Mental stress reactivity can be defined as the magnitude of hemodynamic and emotional responses from baseline levels to acute (mental or emotional) challenge tasks (Krantz, Contrada, Hill, & Friedler, 1988; Manuck, 1989). Hemodynamic and emotional reactivity to a mental stress tasks have been shown to predict subsequent blood pressure level and development of hypertension (Krantz & Manuck, 1984; Manuck, 1989) and cardiovascular mortality (Sheps et al., 2002). In Adults, several studies have linked activation of sympathetic nervous system with progression of atherosclerosis (Kaplan et al., 1996). Evidence suggests that sympathetic activation is associated with increases in distress that may potentiate endothelial injury, precipitating the development of cardiovascular disease (Kaplan et al., 1996).

Optimism and Cardiovascular Reactivity

The present study examined the possible protective factors involved in the reaction to mental and physical challenges. Evidence suggests various health benefits that may result from examining pathways that dampen hemodynamic and emotional responses to stressful challenges. A study conducted by Raikkonen and colleagues (1999) equipped healthy participants with an ambulatory blood pressure monitor for three days combined with a mood diary. Analysis of the data revealed that participants who scored high on pessimism had significantly higher average SBP and DBP levels than optimistic participants. The authors conducted further analyses to determine the effects of mood on ambulatory blood pressure and found that pessimistic individuals had higher SBP and DBP than optimistic individuals throughout the three days regardless of positive or negative mood. Pessimists did experience more negative mood than optimists. However, when the optimists did experience negative mood, they exhibited blood pressure levels as high as those observed in the pessimistic individuals (Raikkonen, Matthews, Flory, Owens, & Gump, 1999).

Van Treuren & Hull (1986) conducted a study measuring systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) responses during a computer-presented logic task. Participants were given either success or failure feedback during the task and measurements of SBP, DBP, and HR were recorded before, during, and immediately after the task, as well as after a three minute recovery period. Optimists exhibited a decrease in SBP over time, whereas pessimists exhibited increases from pretask to posttask measurement, and then decreased from posttask to recovery. An interaction of optimism, time

and condition was observed for measures of DBP and HR. DBP and HR levels of participants high on LOT-assessed optimism decreased from pretask to posttask, but only in the success-feedback condition. For the other groups DBP and HR rose from pretask to posttask and then declined from posttask to recovery.

In a study conducted in our laboratory (DeMoncada et al., 2005), examining the association of optimism and cardiovascular reactivity in healthy controls, patients with coronary artery disease (CAD), and patients with ICDs, it was demonstrated that optimism inversely correlated with SBP reactivity in healthy individuals ($r=-0.25$; $p<0.08$), but among ICD patients optimism and SBP were positively correlated ($r=0.34$; $p<0.03$). No significant relationships were found in CAD patients (DeMoncada et al., 2005). Very little is known about the relationship between optimism and cardiovascular reactivity in children. However, one study conducted in children exposed to violence, demonstrated an inverse relationship between violence exposure and cardiovascular reactivity. However, this relationship was only observed in children high in optimism (Clark, Benkert, & Flack, 2006).

These studies suggest that optimism may influence the cardiovascular reactivity to mental challenges. The present investigation extends this literature by examining the association of optimism and cardiovascular reactivity in children with CHD rather than healthy adults.

Optimism and Immune System Responsiveness

Immunological pathways have also been hypothesized to partially account for the relationship between optimism and positive health outcomes. Inflammatory processes are known to contribute to the progression of coronary atherosclerosis and CAD (Ross, 1999). Although no studies have been conducted on pediatric cardiac patients, there is evidence supporting the possibility that optimism may affect immune system function in other chronically ill populations. Optimism has been associated with higher natural killer cell activity (Levy S, 1987), extent of immune response to antigen challenge (Kamen-Siegel, Rodin, Seligman, & Dwyer, 1991), higher numbers of T-helper cells and higher natural killer cell cytotoxicity (NKCC; (Segerstrom, Taylor, Kemeny, & Fahey, 1998), slower immune decline in HIV positive individuals (Aspinwall, Kemeny, Taylor, & Schneider, 1991), longer survival time in AIDS patients (Reed, Kemeny, Taylor, & Visscher, 1999), and increased T lymphocyte immune cells in response to stressors lasting less than 1 week (Cohen & Herbert, 1996). In contrast to these findings, individuals high in optimism also display decreased T lymphocyte immune cells in response to stressors lasting longer than 1 week (Cohen et al., 1996), and a larger decrement in NKCC when exposed to uncontrollable noise [(Sieber et al., 1999). Kiecolt-Glaser and colleagues (1985) demonstrated that non-depressed individuals display stronger immune system parameter responses to pathogens than depressed individuals. As discussed below, optimism may therefore affect immune functioning by reducing vulnerability for developing depression (Scheier & Carver, 1987). Thus, it is unclear to what extent optimism directly affects immune system function in the

setting of either acute or chronic stress. In addition, the role of immune system parameters in congenital heart diseases is largely unexplored. The effects of optimism on immune system function were therefore not addressed in this project.

b. Health Behaviors and Optimism

It is well known that negative health behaviors (e.g. diet, exercise etc.) increase risk and progression of cardiovascular disease (Krantz et al., 1999). Optimistic individuals are expected to engage in more health behaviors than pessimistic individuals because they reportedly attend to risk behavior information, particularly when it pertains to them personally (Abele & Petzold, 1996; Aspinwall & Brunhart, 1996), and because optimists are more likely to expect positive outcomes when engaging in health behaviors.

Consistent with this theory, research has demonstrated that optimism predicts engagement in health behaviors in a number of chronically ill populations (Robbins, Spence, & Clark, 1991). Taylor and colleagues found that optimistic HIV-positive men made greater efforts to maintain health through diet and exercise. Strack and colleagues (1987) reported that optimism predicted successful completion of a 90-day aftercare program following treatment for alcoholism. Optimistic people were also more likely than pessimistic people to make the concrete and overt behavioral changes necessary to succeed during the transition program.

Research in pediatric populations demonstrates similar findings. Taylor and colleagues (2004) examined the relationship of optimism and activity level in 92 adolescent girls. The authors found that optimism levels were inversely related to sedentary behavior. Similarly, a study conducted by Wright (1996) in children with insulin-dependent diabetes mellitus demonstrated that optimism predicted greater adherence to medical regimen, better metabolic control, and increased psychological adjustment (Wright, 1997).

Surprisingly little research has been conducted on the relationship between optimism and health behaviors in CAD patients. However, there are two studies that demonstrate more engagement in healthy behaviors among optimistic cardiac patients. In a 18-week cardiac rehabilitation program, optimism predicted success in making health changes associated with cardiovascular disease, including increasing aerobic activity, decreasing weight, as well as portion of saturated fat in diet, and blood cholesterol levels (Shepperd, Maroto, & Pbert, 1996). Interestingly, Mumby and colleagues (1995) have demonstrated that although optimistic individuals tended to underestimate their susceptibility to hypertension, engagement in health behaviors was higher, and stress and physical symptoms were reduced compared to pessimistic individuals. These findings add to the evidence that optimism is related to a more active role in treatment and recovery by engaging in various health behaviors. At present, no studies have examined optimism in children with CHD.

c. Psychological Factors

Optimism is associated with several psychological factors that are known to influence health outcomes in adults. Patients with optimistic outcome expectancies display decreased depressive symptoms, and increased engagement in dealing with health-related issues, even when confronted with uncontrollable or unattainable aspects of health in a variety of chronic diseases (Fournier, de Ridder, & Bensing, 2002). Optimism may also provide protective benefits through other psychosocial variables, such as a supportive family environment, which may be relevant to functional outcomes in children with CHD.

Depression

Prevalence of major depressive disorder (MDD) is approximately 2% in children and 4-8% in adolescents. To qualify for Diagnostic Statistical Manual IV (DSM IV) diagnosis of MDD a child must have at least 2 weeks of pervasive change in mood manifested by either depressed or irritable mood, and/or a loss of interest and pleasure. Children must also meet at least 4 additional symptoms of changes in appetite, weight, sleep, activity level, concentration, energy level, self esteem, and motivation. Symptoms must represent a change from previous functioning and produce impairment in relationships or in performance of activities. Furthermore, symptoms must not be attributable to substance abuse, use of medications, other psychiatric illnesses, bereavement or medical issues (American Psychiatric Association, 1994). Although the core symptoms of MDD are the same for children, adolescents, and adults with relatively minor adjustments made to the diagnostic criteria for children, there are some notable

clinical differences across the developmental stages. Children usually show more symptoms of anxiety, somatic complaints, and may express more irritability and frustration with behavioral problems instead of verbalizing their feelings (Birmaher et al., 1996).

Optimism may indirectly improve health outcomes by reducing the incidence of depression in chronically ill individuals. Depression occurs in the context of physical illness more frequently than in the healthy population and is associated with poorer health outcomes including increased mortality in chronically ill patients (McDaniel, Musselman, Porter, Reed, & Nemeroff, 1995). There is an extensive literature demonstrating that optimism correlates negatively with depressive symptoms and distress in both adults and children (Carver et al., 1987); (Hummer, Dember, Melton, & Schefft, 1992; Nolen-Hoeksema, Girgus, & Seligman, 1991; Nolen-Hoeksema, Girgus, & Seligman, 1986; Peterson & Seligman, 1984; Seligman, 1984; Seligman, Castellon, Cacciola, & Schulman, 1988; Utens et al., 1993; Utens et al., 1994). Shnek and colleagues (2001) have documented that optimism was the only significant predictor of decreased depression among ischemic CAD patients one year following hospital discharge, whereas measures of cognitive distortions, self esteem, and helplessness were not predictive of depression. Penedo and colleagues (2003) studied men who had recently undergone a radical prostatectomy, and report that optimism predicted perceived stress management skills which in turn predicted positive mood. Thus, this evidence suggests that optimism is associated with reduced concurrent and future depression. Most of the above listed research on the

association between optimism and depression has relied on self-report measurements of depressive symptoms and not a clinical diagnosis of MDD. This study will also measure depressive symptoms as a measure of acute distress, and not as a clinical condition.

Coping Style

Substantial differences exist in how optimistic and pessimistic individuals cope with critical life situations. Optimistic individuals tend to use more active coping strategies and exert more effort towards goal attainment (Scheier et al., 1999). Even when confronted with serious adversity, optimistic individuals are more likely to exert continuing active coping efforts rather than using avoidant coping styles such as denial or wishful thinking.

One study suggests that optimistic cardiac patients more frequently use problem-focused coping strategies when situations are viewed as controllable, and use more positive reframing when situations are deemed uncontrollable than pessimistic individuals (Scheier et al., 1994). Carver and colleagues (1993) found that optimism was associated with a pattern of active coping strategies, and that optimistic and pessimistic patients' coping tactics strongly related to the level of self-reported distress. Consistent with the aforementioned observations in CAD, coping differences mediated the relationship of optimism and decreased depression and distress.

In Scheier and colleagues' (1989 and 1999) studies on coronary artery bypass surgery patients, optimism was associated with active coping styles, information seeking, goal setting for recovery, and reframing adverse situations.

Pessimistic patients tended to use fatalism, self blame, focus more on the negative aspects of the situation, and use escapism. Positive health effects of optimism of post CABG surgery recovery were mediated by the effect of coping differences (Wrosch & Scheier, 2003). Coping style was not addressed in this dissertation because children's individual coping styles in daily life situations can be substantially influenced by parental oversight and optimal assessment of coping in children is associated with methodological complications that are beyond the scope of the present investigation.

Family Environment

The presence of a chronically or severely ill child in a family is a demanding, emotionally draining, and stressful experience for the child and his or her family (Lavigne et al., 1979). Parents of a chronically ill child purportedly experience heightened depressive symptoms (i.e. feelings of depression, anxiety, confusion, guilt, and stress; (Garson, 1998; Lawoko et al., 2002; Pelchat et al., 1999). Specifically, Lawoko & Soares (2002) compared the levels of distress, depression, anxiety and somatization reported by parents of children with CHD, parents of children with other diseases, such as asthma, and parents of healthy children. Parents of children with CHD reported higher levels of depression than either of the other groups, and higher levels of anxiety, somatization, and hopelessness than the parents of healthy children. These parental psychological characteristics were above established psychometric norms, suggesting clinically meaningful elevations in parental distress. Even in cases where the child's illness is benign and physical restrictions are not

required, parents may continue to perceive the child as having “something wrong with his/her heart” and maintain restrictions on the child’s activities (Garson, 1998) p. 2930). Parental over protectiveness can interfere with children’s quality of life and impinge on normal development (Garson, 1998).

The initial presence of CHD significantly elevates levels of parenting stress, stress appraisal, and psychological distress in parents of 6-month-old children (Pelchat et al., 1999). Parents of children with CHD report elevated scores on parental stress, stress appraisal, psychological distress, and loss of control as compared to parents of infants with cleft lip/palate (CLP) or parents of children with no disability. Gardner et al. (1996) reported that both infants with CHD and their mothers displayed less engagement and less positive affect than mother-infant dyads with other illnesses. Also, Goldberg et al. (1991) found that significantly more infants with CHD than healthy controls displayed insecure attachment towards their mother and that those who displayed a secure attachment were healthier at the one-year follow-up. These results demonstrate that CHD affects parent-child interactions during infancy, which can interfere with the function and development of future familial relationships.

Siblings can be affected by the parents’ reactions to and relationships with a child with CHD and sibling interactions can play an important role in the family environment. Siblings may experience perceived or actual neglect because the parents spend relatively more time with the sick child (Garson, 1998). Lavigne and Ryan (1979) found that siblings of children with a chronic illness, such as CHD, displayed significantly more social withdrawal and irritability and higher

levels of overall disturbances than siblings of healthy children. Distressful emotions of parents and other members of the family affect the interpersonal relationships and functioning of the entire family, as well as the personality and behavior of the child with CHD. Dysfunctional family environment has been shown to be related to altered ANS activity (Wright et al., 1993). This study examines how the family environment may influence the association of optimism with hemodynamic and ANS reactivity to laboratory challenge tasks.

Summary and Hypotheses

Dispositional optimism is related to a variety of positive health outcomes including reduced recurrent fatal and non-fatal events in adults with CAD (Giltay et al., 2004; Giltay et al., 2006; Helgeson, 2003a; Helgeson et al., 1999; Scheier et al., 1999; Scheier et al., 1989). Substantial progress has been made in delineating pathways accounting for the association between optimism and reduced adverse health outcomes in adults, but little is known about these associations among pediatric populations. It is known that children with CHD are at greater risk for cardiovascular disease in adulthood. It is important to determine whether the association between optimism and cardiovascular reactivity demonstrated in adults is also present in pediatric populations. The present investigation examined the following hypotheses:

Hypothesis 1: Levels of optimism will be inversely associated with distress levels among children with congenital heart defects. This association is anticipated to remain significant when adjusting for measures of family environment.

Hypothesis 2(a): Levels of optimism will be associated with reduced cardiovascular reactivity during challenge tasks (mental arithmetic, computer challenge, mirror trace, and cold pressor) among children with congenital heart defects. Measures of cardiovascular reactivity include: heart rate, systolic and diastolic blood pressure responses, and heart rate variability-derived measures of vagal tone. It is expected that these associations will remain significant when adjusting for measures of family environment.

Hypothesis 2(b): The association between optimism and reduced cardiovascular reactivity will be mediated by individual distress levels among children with congenital heart defects. These associations are anticipated to remain significant when adjusting for measures of family environment.

These hypotheses were examined in two groups: patients with surgically corrected CHD, and patients with uncorrected minor CHD. These two groups were studied to determine whether disease severity influenced the results. No a priori differences across the two CHD groups were anticipated in the optimism-reactivity associations.

RESEARCH DESIGN AND METHODS

I. General Overview

Psychological and physiological parameters were assessed in 24 participants with corrected congenital heart disease and 15 participants with uncorrected congenital heart disease (Total N = 39). As shown in Figure 2, participants were tested during one continuous laboratory visit. Patient testing and data collection were conducted at the Walter Reed Army Medical Center, Washington, DC (WRAMC). The protocol was approved by the WRAMC and the USUHS Institutional Review Boards (Appendix D).

II. Participants

The sample consisted of 39 male and female children with congenital heart disease, between 6 and 12 years of age, and their parents or other primary care provider (N = 39). Two groups of children were enrolled; “Group 1” children with sub-clinical, uncorrected CHD (N=15 children and N=15 parents); “Group 2” children with surgically corrected CHD without residual symptoms (N=24 children and N=24 parents). Participants were recruited through the Department of Pediatrics at Walter Reed Army Medical Center (WRAMC) under the supervision of the Chief of the Department of Pediatrics, Thomas Burklow, MD. The exclusion criteria for children included: (1) currently under psychiatric treatment

or treatment for a mental or psychological disorder, (2) taking medications that could potentially effect HRV, such as Digoxin, calcium channel blockers, beta blockers and ACE inhibitors, and (3) diagnosed neurological disorder or severe developmental delay which would inhibit the child's ability to understand or cooperate with the study protocol. Prior to study participation, the parent's informed consent and children's assent was obtained in accordance with Federal and WRAMC regulations. Examples of the parent consent form and child assent form are presented in Appendix E.

III. Procedures

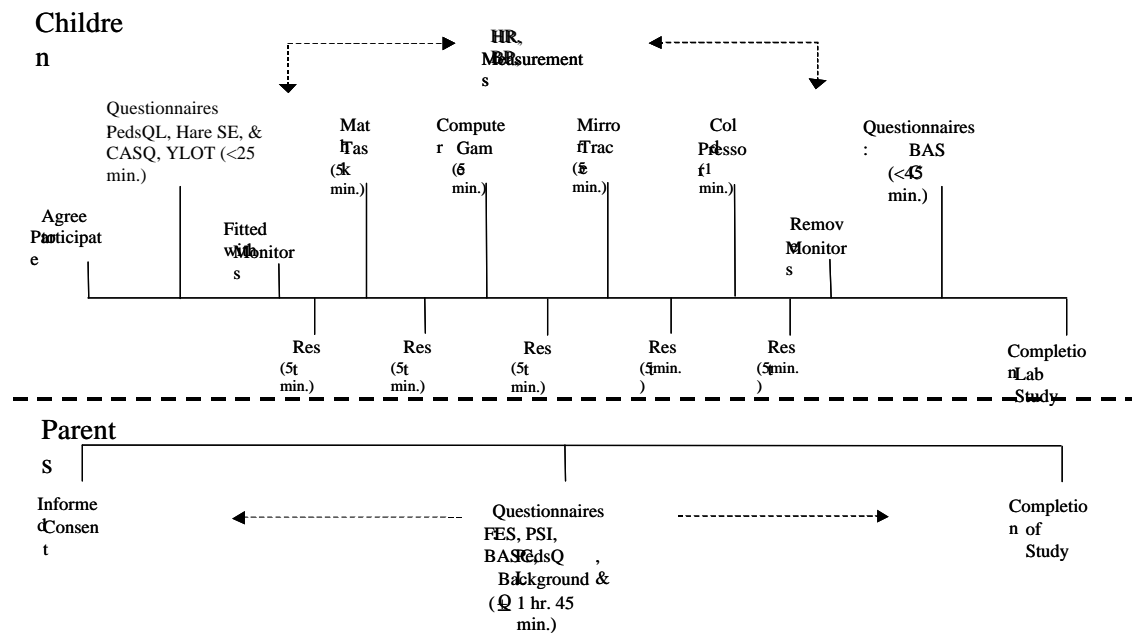
The WRAMC pediatric cardiology clinic serves over 1800 patients. A total of 363 patients were screened from the clinic schedule lists as in the qualifying age group and 114 were identified as potentially eligible by the collaborating cardiologist on this project. Ninety four of these 114 were approached and 39 consented to participate. Reasons for declining to participate were primarily scheduling issues (18); other reasons included, inconvenience of traveling to WRAMC unnecessarily, not wanting to subject the child to additional perceived medical procedures, and uninterested in participating.

Participant testing and data collection was performed at WRAMC. Once parents signed the informed consent form and children agreed to participate, parents and children filled out a set of questionnaires. As shown in Figure 2, children filled out the PedsQL, CASQ, selected items from the YLOT, and Hare

Self-esteem questionnaires prior to completing the structured tasks. The children were then fitted with a heart rate monitor and blood pressure cuff. After a 5-minute rest period, the child began a set of structured activities (age-appropriate mathematics, computer game, mirror trace, and forehead cold pressor) while blood pressure and HR measurements were obtained. Each mental task was 5 minutes with a 5-minute rest between each task. The order of the first three tasks was randomized, ending with the cold pressor to limit carry over effects of the latter task. The total time to complete these procedures was less than 40 minutes. Once the tasks were completed, the monitors were removed and the child completed the Behavioral Assessment System of Children (BASC) questionnaire in a separate room with the investigator or a trained research assistant present. Completion of the remaining questionnaires took no longer than 45 minutes. Questionnaires were read aloud to children who were unable to read and help was provided when necessary regarding content of the questions.

Both mental and physical challenge tasks were included in order to investigate whether the anticipated reduced reactivity related to optimism levels reflected altered reactivity specific to psychological challenge tasks or altered reactivity in general. Details of these tasks are described below.

Figure 2: Outline of Study Procedures.



Parents completed the following questionnaires to evaluate family environment characteristics and child behavioral measures: The Parental Stress Index (PSI), the Family Environment Scale (FES), the BASC parent report, and the Peds QL parent report. These questionnaires were completed within 1 hour.

IV. Measures Obtained During the Study

a. Assessment of Optimism

The Children's Attributional Style Questionnaire (CASQ) has been developed to measure optimistic attributional style (Seligman et al., 1984). The CASQ is a 48-item, forced choice, self report questionnaire (see Appendix A).

Each item on the CASQ includes a sentence describing a good or bad event, such as, “You get an A on a test,” and two phrases describing possible causes of that event, such as “because I am smart.” or “because I am good at the subject the test was in.” Children are asked to imagine the event happening to them and to check which of the two causes describes why that event happened. The CASQ includes 24 positive events and 24 negative events related to school and sports achievement, peer relationships, and relationships with parents. Scores range from -24 to +24 with higher scores reflecting more optimistic explanatory style. This inventory has demonstrated satisfactory reliability (Cronbach’s $\alpha = 0.54 - 0.73$).

The Youth Life Orientation Test (YLOT) has been developed to measure optimism levels based on expectancy of positive outcomes (see Appendix A). One study has validated this measure in healthy populations, but no studies have used this measure with diseased children. A sample of 5 questions from this questionnaire was also be given to the participants in this study to determine whether results differ using a measure of generalized expectancy or attributional style. The score range for the YLOT is 0-40 and the average value for the full YLOT (12 items) is 24.85 ± 5.87 .

b. Child Characteristic Questionnaires

Child characteristics, including behavioral and psychological factors, were measured using the Behavior Assessment System for Children (BASC)

(Reynolds & Kamphaus, 1992; see Appendix B). The Behavior Assessment System for Children is a 138-item inventory that assesses the child's behavior and feelings. It includes 12 scales: aggression, conduct problems, hyperactivity, anxiety, depressive symptoms, somatization, attention problems, atypicality (odd behavior or thoughts), withdrawal, adaptability, leadership, and social skills. Scores are transformed to normative standardized t-score (i.e., population mean = 50, s.d. = 10) and values below 50 indicate lower levels of target characteristics than the age- and sex-matched population [angle, check if this is correct]. The subscale test-retest reliabilities for 2-8 week time periods range from .84 to .92 and the internal consistency ranges from .64 to .90 (Reynolds et al., 1992). Both the Parent Rating Scales for Children and the Self-report forms for children were used to examine potential differences in the child's versus the parent's perspective on the child's behavioral and psychological characteristics.

c. Contextual Psychosocial Measures

Because a variety of psychological factors may influence physical and psychological outcomes in patients with CHD, this study examined family environment, parental distress, control, and protection as potential covariates. These questionnaires are presented in Appendix C. The defining characteristics of the family environment, including the quality of the interrelationships between family members and the levels of distress experienced by the parents, were

measured using the Family Environment Scale (FES; (Moos & Moos, 1986) and the Parenting Stress Index (PSI; (Abidin, 1990).

The Family Environment Scale is a 27 item, true false inventory that measures levels of conflict, cohesion, expressiveness, control, positive affiliation, and authoritarianism within the family (Moos et al., 1986). Scores range from 0-27 with higher scores reflecting a more favorable family environment. The FES has three subscales. Scores on the family cohesion, expressiveness, and family conflict subscales range from 0-9. The test-retest reliabilities for the subscales range from .42 to .91 over periods of 1-3 years, and the internal consistencies for the subscales range from .61 to .78 (Wright et al., 1993). These family environment characteristics have been shown to correlate with healthy children's cardiovascular responses to laboratory stressors (see Introduction; Woodall & Matthews, 1989; Wright et al., 1993).

The Parenting Stress Index is a 120-item self-report inventory that measures overall perceived stress as well as three specific areas of stress related to parent, child and life events. This measure has been used previously with parents of children with CHD (Pelchat et al., 1999). Goldberg et al. (1997) found that ratings on the PSI were the strongest predictors of child behavior problems in children with CHD, cystic fibrosis, and healthy children (see Introduction). Test-retest reliability for the PSI ranges from .71 to .82 at three weeks (Burke, Joyner, Czech, & Wilson, 2000), and from .69 to .88 at a three-month interval (Zakreski, 1983).

d. Mental and Physical Challenge Tasks

The autonomic nervous system (ANS) is responsible for the cardiovascular reactivity to challenge tasks. There are two subdivisions of the ANS, the sympathetic nervous system (SNS,) and the parasympathetic nervous system (PNS). SNS activation increases cardiovascular response to challenge, while PNS reduces responses to challenge. Specifically, SNS activation can increase beta-adrenergic response to increase HR and contractility of the heart, as well as alpha-adrenergic response which increases vasoconstriction. PNS activation decreases HR through decreasing the firing rate of the SA node and has little effect on SV, TPR, or BP. Therefore, these different mechanisms cause different patterns of cardiovascular reactivity. Beta-adrenergic activation causes increase in HR, Stroke volume and cardiac output, while alpha-adrenergic activation increases SBP, DBP, and total peripheral resistance (TPR, Guyton & Hall, 2002). Mental challenge tasks shown to elicit different patterns of cardiovascular response were chosen for this study. The mental arithmetic and computer game tasks have been shown to elicit a strong beta-adrenergic responses, while the mirror tract and cold pressor tasks elicit a strong alpha-adrenergic activation (Matthews et al., 1997).

Mental Arithmetic Task: Participants were asked to verbally subtract serial 7's from a 3 digit number for a period of 5 minutes. Participants were instructed that their performance was rated for speed and accuracy, and to try as hard as they could. This task was modified based on the age and mathematical ability of the participant such that if serial 7's were too difficult, serial 3's, or 2's was

substituted. Children were encouraged to work as hard as possible, but were not harassed as is commonly done in cardiovascular behavioral medicine studies in adult populations.

Computer Challenge Task: Participants were asked to play the computer game “Super Collapse” for a period of 5 minutes. The object of the game is to eliminate colored tiles as the tiles rise one row at a time. When the tiles reach the top of the screen, the game is over. Points are earned by eliminating tiles and when enough tiles have been eliminated the player can move to the next level, where the game proceeds at a faster pace. The difficulty can be set at the beginner, moderate, or advanced level. Participants were asked to play for 5 minutes while trying to earn as many points as possible. If the game ended before the 5 minute time limit, the game was restarted and the scores summed. Tasks of reaction time have been shown to elicit a beta-adrenergic pattern response in participants (Matthews et al., 1997).

Mirror Trace Task: Participants were asked to trace a star on an electronic board with an electronic pen. Participants were only allowed to see a mirror image of the star. When patients moved off of the star, a buzzer sounded. If participants traced the star three times, without errors, they were asked to use their non-dominant hand. Errors were recorded as an index of success in task completion. This task has been shown to elicit an alpha-adrenergic response in participants (Matthews et al., 1997).

Cold Pressor Task: After the completion of the mental challenge tasks an ice pack was placed on the participant's forehead for 1 minute. Participants were

told that they must leave the ice pack on for at least one minute, but asked to leave it on after that as long as they can stand (up to 2 minutes). The total length of time that the participant maintained contact with the ice pack was recorded. The ice pack was turned every 30 seconds to reduce the artifacts related to temperature change resulting from body heat emission. This task has been shown to elicit a strong alpha-adrenergic activation in participants (Matthews et al., 1997).

e. Acute Emotional Reactivity to Mental and Physical Challenge

At completion of each mental and physical challenge task participants were asked to rate how they felt about completing the task on a Likert scale of 1 (not at all) to 5 (very much). The items included: enjoyed, annoyed or bothered, and interested. Participants were trained on the Likert scale prior to the first rest period. Ratings were obtained following the completion of each of the challenge tasks. Participants' ratings for each task will be used to determine emotional reactivity to the mental challenge task without correcting for baseline levels of the Likert scales (Scheier, Carver, and Bridges, 1994). Baseline ratings will be used to determine whether there are differences between the study groups and whether optimism is related to a positive response set during challenge.

f. Cardiovascular and Autonomic Nervous System Activity

During rest and challenge tasks, blood pressure and heart rate were obtained using a Ditimap automated cuff placed on the non-dominant arm. Participants were asked to refrain from moving their arm while the cuff inflated. SBP, DBP, and HR were obtained every two minutes throughout the protocol. Resting blood pressure and heart rate levels were determined by averaging the last two resting measures during the rest period. During mental challenge tasks, hemodynamics were assessed every two minutes (the peak of these measurements was used as primary indicator of the cardiovascular response). Arithmetic change scores were calculated by subtracting the peak task measures from the aggregated baseline levels (Kop, Gottdiener, Patterson, & Krantz, 2000). This procedure enabled determination of increases in hemodynamic measures while taking baseline levels into account.

Three general strategies for calculating reactivity scores have previously been described: (1) the aggregated baseline change scores strategy where the entire combined baseline measures prior to a series of tasks are averaged to compute an overall baseline to subtract from the individual task level (used in this study); (2) the residual change score method, where a regression line is calculated for the relationship between baseline and task measures and then the residual values from the regression line are used as the reactivity measures; and (3) arithmetic change scores calculated by subtracting the peak task measures from the preceding baseline measures (Kop et al., 2000).

Kamarck et al. (1992) provide support for an aggregated baseline across tasks as the proper manner in which to perform a baseline cardiovascular

evaluation because the “baseline” cardiovascular measures tend to drift upwards across repeated challenge tasks. The paradigm employed by Kamarck et al. (1992), used tasks lasting approximately 6-10 minutes with minimal rest period, (± 5 min) between each task (Kamarck, Jennings, Debski, & Glickman-Weiss, 1992). Because of the similarities between the Kamarck et al., procedure and the present study, the aggregated baseline approach was employed here.

Manuck (1989) provide evidence in support of a residual change score approach. The residualized change score quantifies the physiologic responses to challenge tasks, while separating the influence of baseline levels from these responses using the correlation between baseline and task levels. Although there are occasions in which the residualized change score differs from the basic change score, these occasions are rare (Manuck, 1989). Also, the reliability of both residualized change scores and basic arithmetic change scores are comparable (Kamarck et al., 1992). Furthermore, the residual change score approach implies a linear relationship between baseline and task levels, which is not necessarily a valid assumption.

Therefore, arithmetic change scores from the aggregated baseline levels to peak levels during the arithmetic, computer, mirror trace, and cold pressor tasks was used because this method is directly based on the raw data, adjusts for baseline drift, and it is comparable in reliability and outcome to the other two methods (Kamarck et al., 1992; Manuck, 1989).

Heart rate variability during rest and during challenge tasks was measured by off-line analysis of digitized electrocardiograms (ECG) using a Holter device

(Massin et al., 1998a; Massin et al., 1998b). These changes in the interval between subsequent heart beats represent the autonomic balance of both the sympathetic and parasympathetic nervous systems control of cardiac rhythm. ECGs were analyzed for single minute epochs before and during each task. A semiautomatic software program (MARS PC 6.01, GE Medical Systems Information Technologies, 2003) was used to divide HRV measures into low Frequency (.04-.15 HZ), high frequency (.15-.4 Hz) and LF/HF ratio using spectral analysis by Fast Fournier Transform to separate R-R intervals. This program required a 5-minute time frame for each single minute of analysis. R-R intervals of the 2 minutes prior to and 2 minutes following the minute of interest were used to determine HR trends for each single minute of HRV analysis. A natural logarithmic transform of the power of each frequency band was used to normalize the data and the resultant power is described in $\ln(\text{ms}^2)$. Holter tapes were analyzed by hand and all abnormal beats (including supraventricular beats) were removed prior to analysis to obtain a pure index of HRV without irregularities. Time domain measures of HRV were also provided by the MARS software program. Specifically time domain measures of HRV included mean of the NN interval (NN), standard deviation of the NN interval (SDNN), standard deviation of the average NN interval (SDANN), average standard deviation of the NN interval (ASDNN), and square root of the mean squared differences of successive NN intervals (RMSSD). We used HF HRV as the primary index of ANS responses because this measure is the preferred measure for short-term parasympathetic responses to challenge tasks (Malik et al., 1996),.

V. Statistical Analyses and Power Calculation

Power analyses were conducted to determine the necessary sample size for the current investigation. The alpha (Type I error) level was set at 0.05, and power was set at 80%. The number of variables in the regression model was set at 5 for Hypotheses 1, and 2a and at 6 for the regression model for Hypothesis 2b. To detect a small effect size of 0.25 for Hypothesis 1, and 2a, 45 participants would be needed, and 48 participants for Hypothesis 2b. Thus, the proposed sample size of 50 participants would have been sufficient to detect a small effect size for all hypotheses at a power >80% ($\beta < 0.20$) with a Type I error (α) set at <0.05 (two-tailed). All power calculations were performed with the nQuery Advisory power calculation software package.

To test the hypotheses of the current study, the statistical analysis for each of the hypotheses is presented below. Data were analyzed using SPSS for Windows Version 12 (SPSS Inc; Chicago, Illinois).

Hypothesis 1: Levels of optimism will be inversely associated with distress levels among children with congenital heart defects. This association is anticipated to remain significant when adjusting for measures of family environment.

Statistical analysis: To examine the association between optimism and distress we will use a multivariate regression analysis (MRA). Bivariate

correlation analyses were conducted first to examine the associations among the study variables. The MRA included 5 variables; optimism, group status and the interaction of optimism and group status were entered in a hierarchical linear regression model, controlling for family environment measures and demographics. The dependent variable was the child's distress level measured by the behavioral symptom index composite score of the Behavior Assessment System for Children Self Rating, and the parallel parent rating.

Hypothesis 2(a): Levels of optimism will be associated with reduced cardiovascular reactivity during challenge tasks (mental arithmetic, computer challenge, mirror trace, and cold pressor) among children with congenital heart defects. Measures of cardiovascular reactivity include: heart rate, systolic and diastolic blood pressure responses, and measures of heart rate variability-derived vagal tone. It is expected that these associations will remain significant when adjusting for measures of family environment.

Statistical analysis: To examine the association between optimism and cardiovascular reactivity during mental challenge tasks multivariate regression analyses were used. Bivariate correlation analyses were conducted first to examine the associations among the study variables. Optimism, group status and the interaction of optimism and group status were then be entered in a hierarchical linear regression model controlling for family environment measures. The dependent variables were heart rate, systolic, and diastolic blood pressure, and heart rate variability. Separate regression analyses were be conducted for

each of the challenge tasks; mental arithmetic, computer challenge, mirror trace, and cold pressor.

Hypothesis 2(b): The association between optimism and reduced cardiovascular reactivity will be mediated by individual distress level among children with congenital heart defects. These associations are anticipated to remain significant when adjusting for measures of family environment.

Statistical analysis: To examine whether the association between optimism and cardiovascular reactivity (H2a) is mediated by child distress levels analyses, the methods of Baron & Kenny (1986) were followed. As was proposed in the current investigation, the following conditions must hold: the independent variable (i.e. Optimism) must affect the dependent variable (i.e. cardiovascular reactivity), the independent variable must affect the mediator (i.e. child distress), and the mediator must affect the dependent variable (Baron & Kenny, 1986). In addition, perfect mediation occurs if the independent variable has no effect when the mediator is controlled for. To test the mediational model shown in Figure 1, a series of linear regression analyses were conducted with optimism as the independent variable, cardiovascular reactivity as the dependent variable, and child distress as assessed by the BASC, as the mediator. The first condition for the mediational model would be demonstrated by hierarchical linear regressions performed in H2a. The second condition would be demonstrated in the hierarchical linear regressions performed in H1. To demonstrate the final condition and determine mediation (H2b), child distress was included as an

additional variable to the hierarchical linear regression model conducted for H2a. Consistent with H2a, separate analyses were conducted for each of the challenge tasks, mental arithmetic, computer challenge, mirror trace, and cold pressor. When optimism significantly predicted cardiovascular response (SBP, DBP, HR, or HRV) to a challenge task, child distress was added to the regression model used in H2a. If the level of child distress accounts for a significant amount of the variance beyond that accounted for by optimism, this will demonstrate that child distress mediates the relationship between optimism and cardiovascular responsiveness.

RESULTS

I. Demographic Characteristics

Sample characteristics for demographic measures, disease severity indicators, and baseline hemodynamics are presented in Table 1. The sample consisted of 24 children who had corrective surgery for CHD (Group 1; surgically corrected), and 15 children who had mild CHD and had not had corrective surgery (Group 2; non-surgical; see Table 1). Overall participants were 69.2% Caucasian, 20.7% African American, 2.6% Asian American, and 7.7% other. The surgically corrected participants were 58.3% male, with a mean age of 9.1 ± 2.2 years. The non-surgical participants were 53.3% male, had a mean age of 8.7 ± 2.0 years. The groups did not differ statistically from each other with regard to sex, race, age, percent taking any form of medication, or family environment.

CHD diagnoses varied greatly between the groups. In the non-surgical group 5 patients had valve dysfunction (33.5%), 4 patients had aortic or pulmonary stenosis (26.8%), 1 patient had a ASD (6.7%), 1 patient had VSD (6.7%), 1 patient had a fistula (6.7%), 1 patient had patent duct anonymlly (6.7%), and 2 patients had a multiple diagnoses (13.4%). Patients in the surgically corrected group had more severe diagnoses or symptoms. Specific diagnoses were 2 patients had valve dysfunction (8.4%), 3 patients had aortic or pumonary stenosis (12.6%), 2 patients had ASD (8.4%), 5 patients had VSD

(21%), 5 patients had transposition of the great arteries (21%), 2 patients had Tetralogy of Fallot (8.4%), 1 patient had a coarctation of the aorta (4.2%), 1 patient had Ebstein's syndrome (4.2%), 1 patient had VCFs syndrome (4.2%), and 3 patients had multiple diagnoses (12.6%). As expected, surgically corrected participants had significantly more days of being hospitalized, days absent from school, feeding difficulties as infants. Baseline SBP, DBP did not differ between the groups and HR was higher in the non-surgical group (Table 1), which may in part reflect the HR-lowering effects of cardiac medications in the surgical group.

II. Examination of Hypotheses

Hypothesis 1. Levels of optimism will be inversely associated with decreased distress among children with congenital heart defects. This association is anticipated to remain significant when adjusting for measures of family environment.

Optimism

Means and standard deviations for CASQ total score, CASQ positive and negative items, and YLOT are presented in Table 2. There were no differences in CASQ or YLOT scores between the two groups. Mean CASQ total score for the non-surgical group was 6.77 ± 4.33 , and for surgically corrected patients was 6.91 ± 4.81 . Mean score for the selected YLOT items for the non-surgical group was -1.00 ± 2.83 , and for surgically corrected patients was 0.00 ± 3.21 . The

CASQ and YLOT items were not significantly correlated ($r = 0.25$, $p = 0.42$) in the current study.

Child Distress

Child distress scores and other behavioral and psychological characteristics are presented in Table 3. The Composite and subscale scores from the Behavioral Assessment System for Children (BASC) were used to measure emotional distress. Specific measures included Behavioral Symptom Index (BSI); BASC composite of emotional symptom self report (BASC-Comp-Emotional-C); BASC composite of internalizing behaviors parent report (BASC-Comp-Internalizing-P); BASC composite of externalizing behaviors parent report (BASC-Comp-Externalizing-P); and both the self and parent ratings of anxious and depressed mood. The surgical and non-surgical groups did not differ in any of these BASC subscales (Table 2).

Relationship Between Optimism and Child Distress

Correlations between child distress level and optimism were conducted for the total sample ($N = 39$) within each of the two CHD groups separately (see Table 4.a: parental ratings, and Table 4.b: child ratings). In general, associations between optimism (child-reported) and measures of distress and other psychological characteristics were stronger when parental BASC ratings were examined in comparison to the children's BASC self report. In the non-surgical group, optimism, as measured by the CASQ, was inversely correlated with BSI-P, BASC-Comp-Externalizing-P, and anxiety parent rating. In the surgically

corrected group, optimism was only inversely correlated with BASC-Comp-Externalizing-P.

To examine the association of optimism and child distress a hierarchical linear regression model with 3 sets was conducted for each of the 8 measures of distress (i.e. BSI-C, BSI-P, BASC-Comp-Emotional-C, BASC-Comp-Internalizing-P, BASC-Comp-Externalizing-P, anxious-C, anxious-P, depressed-C, and depressed-P). The first set examined the effect of group status (surgically corrected or non-surgical); the second set examined the effect of optimism; and the third set examined the interaction between optimism and group status. Significant relationships between optimism and child distress were found in 3 of the 8 models, whereas neither group status nor the interaction between optimism and group reached significance. Thus, the results reveal that optimism was related to lower parental ratings of their child's distress levels (BSI-P, R^2 Change_{optimism} =0.21; F Change =8.29; $p < 0.01$), BASC-Comp-Externalizing-P (R^2 Change_{optimism} =0.25; F Change =10.62; $p < 0.001$), and anxiety parent rating (R^2 Change_{optimism} =0.13; F Change =4.76; $p = 0.04$, but not for BSI-C (R^2 Change_{optimism} =0.13; F Change =3.68; $p = 0.07$), BASC-Comp-Emotional-C (R^2 Change_{optimism} =0.02; F Change =0.56; $p = 0.46$), BASC-Comp-Internalizing-P (R^2 Change_{optimism} =0.07; F Change =2.42; $p = 0.13$), anxious-C (R^2 Change_{optimism} =0.03; F Change =0.88; $p = 0.36$) depressed-C (R^2 Change_{optimism} =0.04; F Change =1.04; $p = 0.32$), or depressed-P (R^2 Change_{optimism} =0.02; F Change =0.73; $p = 0.40$). The interaction terms (i.e., group status x optimism) were not

significant for any of the analyses, indicating that the associations between optimism and lower distress were consistent across the two CHD groups.

Role of Family Environment

To examine the role of family environment, the bi-variate associations between the FES, the BASC subscales, and optimism were examined first (Table 5). The only consistent association was found between elevated family distress (lower FES scores) and increased anxiety levels (i.e., reflected by negative correlations). To examine whether the family environment plays a role in the association between optimism and lower levels of distress in children with CHD, three additional regression models were conducted. The FES assessment of family environment was added to the aforementioned multivariate regression models that revealed significant associations with optimism (Table 4) to examine whether the significant findings were attributable to the family environment. The fully adjusted model included step 1 family environment; step 2 group status; step 3 optimism (CASQ); and step 4 interaction between optimism and group status. As displayed in Table 6.a., in the fully adjusted model family environment did not contribute significantly to the parental ratings of the child's distress level ($\text{BSI-P } R^2 \text{ Change}_{\text{FES}} < 0.001$; $F \text{ Change} = 0.07$; $p = .79$) while the main effect of optimism was retained ($R^2 \text{ Change}_{\text{optimism}} = 0.19$; $F \text{ Change} = 6.96$; $p = .01$). The same pattern of results held for BASC-Comp-Externalizing-P ($R^2 \text{ Change}_{\text{FES}} < 0.001$; $F \text{ Change}_{\text{FES}} = 0.03$; $p = 0.86$; $R^2 \text{ Change}_{\text{optimism}} = 0.23$; $F \text{ Change}_{\text{Optimism}} = 9.24$; $p = .01$); see Table 6.b.). In contrast, after adjusting for family environment,

the relationship between optimism and anxiety-P was nonsignificant (see Table 6.c.).

Thus, support was found for significant associations between the child's level of optimism (CASQ) and parental impressions of the child's distress level. No support was found for relationships between the child's optimism levels and his/her own perceived distress levels. In addition, no added influences were found for group status (surgical versus non-surgical CHD), or family environment in the relationship between optimism and child's distress levels.

Hypothesis 2a. Levels of optimism will be associated with reduced cardiovascular reactivity during challenge tasks (mental arithmetic, computer game, mirror trace, and cold pressor) among children with congenital heart defects. It is expected that these associations will remain significant when adjusting for family environment. Measures of cardiovascular reactivity included: systolic and diastolic blood pressure, heart rate, and heart rate variability-derived measures of vagal tone.

Analyses examining SBP, DBP, and HR, will be presented first, followed by the analyses of the HRV measures. Mean baseline and peak SBP, DBP, and HR scores are presented in Table 8a. Heart rate variability measures included time domain measures (mean of the NN interval (NN), standard deviation of the NN interval (SDNN), standard deviation of the average NN interval (SDANN), average standard deviation of the NN interval (ASDNN), square root of the mean squared differences of successive NN intervals (RMSSD), and frequency domain

measures (power in the low frequency range (LF), power in the high frequency range (HF), and the low frequency to high frequency ratio (LF/HF). Mean baseline and peak heart rate variability scores are presented in Tables 8.b. and 8.c.)

Task Response:

Acute emotional response to challenge task was measures following the completion of each task. Means and standard deviations are presented in Table 7. Values for the extent the participants liked, were annoyed by, or were interested in the task demonstrate that the participants were actively engaged in the tasks and interested in performing the task appropriately. The mental and physical challenge tasks produced significant increases in SBP, DBP, and HR from baseline to peak in all of the challenge tasks (math, computer, mirror, and cold pressor) in both CHD groups (see Table 8.a). Only the mental arithmetic and cold pressor tasks elicited significant changes in HRV measures (higher SDNN (MA and cold) and ASDNN (cold), and lower SDANN (cold), ASDNN, lower LF and HF (cold) and increased LF/HF ratio (cold; Tables 8.a. and 8.b.). Analyses were also conducted to determine whether hemodynamic measures and HRV recovered fully following the challenge tasks. Results revealed that baseline measures collected prior to the first challenge task did not significantly differ from those collected prior to the last challenge task, which supports the absence of a drift in baseline values. For HRV, the first resting HRV assessments were used as baseline values to avoid carryover effects of the tasks on between-task HRV assessments (related to the HR trending – see Methods for details).

Task Order Effects

Although the task order was counterbalanced to control for any task-sequence interactions, statistical analyses were conducted to ensure order effects were not present in the current study. Specifically, the order the task was completed in was coded for each task and regression analyses were conducted. Regression analyses revealed the order a task was completed did not significantly effect hemodynamic or HRV reactivity outcomes.

Acute Emotional Reaction to Challenge

Correlations between optimism and acute emotional reactivity during each of the challenge tasks are presented in Table 9.a. As can be seen in table 9.a. analyses revealed a significant inverse correlation between optimism and how much the participants liked completing the cold pressor task when examining the total sample (N = 39). Similar to the total sample there was a significant association between optimism and how much the participants liked the cold pressor task among the surgically corrected participants. Surgically corrected patients also demonstrated a significant relationship between optimism and how much the cold pressor task annoyed them. Analyses revealed no significant relationships between optimism and acute emotional reaction among non-surgical participants.

Hemodynamic Reactivity During Challenge

Correlations between optimism and hemodynamic reactivity during baseline, and each of the challenge tasks are shown in Table 9..b Correlations between optimism and heart rate variability measures are shown in Tables 9.c.

and 9.d. Hemodynamic reactivity (i.e., change scores) was defined as arithmetic change score from the aggregated baseline to peak level during the mental challenge and cold pressor tasks. For HRV reactivity, the first baseline was used as reference.

As can be seen in table 9.b. analyses revealed no significant correlations between optimism and SBP, DBP, or HR measures during any of the challenge tasks when examining the total sample (N = 39). Similar to the total sample there were no significant associations between optimism and cardiovascular reactivity measures among the surgically corrected participants and the non-surgical participants. Although correlations between optimism and cardiovascular reactivity across groups was unremarkable, when analyzed by group, several variables resulted in strong correlations during the challenge tasks, despite not reaching statistical significance. The pattern of results suggests that the associations with optimism were in the expected direction in the non-surgical group, whereas associations were in the opposite direction in the surgically treated group.

Exploratory analyses were conducted to more thoroughly examine these associations for the 5 hemodynamic variables that demonstrated the strongest correlations with optimism in at least one of the groups during the various tasks. The 5 hemodynamic reactivity variables were: SBP, DBP, and HR reactivity during the mirror trace task, and HR reactivity during the computer game and the cold pressor task. Hierarchical linear regression models included 3 steps. The first step of the hierarchical linear regression model examined the effect of group

status (surgically corrected vs. non-surgical CHD patients); the second set examined the effect of optimism; and the third set examined the interaction between optimism and group status. Of the 5 regression models conducted none revealed a significant relationship between optimism and hemodynamic reactivity or an interaction between optimism and group status.

The Role of Family Environment

To examine the role of family environment, the FES assessment of family environment was added to the aforementioned models to examine whether the previous findings were attributable to this variable. The fully adjusted model included step 1 family environment; step 2 group status; step 3 optimism (CASQ); and step 4 the interaction between optimism and group status. Results revealed that family environment contributed significantly to the overall model for SBP reactivity (SBP-Mirror R^2 Change_{FES} 0.12; F Change =4.23; $p=0.05$) and DBP reactivity (DBP-Mirror R^2 Change_{FES} 0.18; F Change =7.23; $p=0.01$) during the mirror trace task; but not to HR reactivity during the mirror trace task (HR-Mirror R^2 Change_{FES} 0.02; F Change =0.52; $p=0.48$), HR during the computer game (HR-Computer R^2 Change_{FES} <0.01; F Change =0.22; $p=0.65$), nor HR during the cold pressor (HR-Cold R^2 Change_{FES} <0.01; F Change =0.05; $p=0.82$) (Table 10.a. through 10.e.). As displayed in Tables 10.a. through 10.e., optimism did not add to the prediction of hemodynamic measures when examining the expanded models, which is consistent with the non-significant bivariate correlations between optimism and hemodynamic reactivity (Table 9).

Heart Rate Variability During Challenge

HRV reactivity (i.e., change scores) was defined as arithmetic change score from the baseline to level during the mental challenge and cold pressor tasks. Similar to the results of the hemodynamic measures, heart rate variability reactivity measures did also not demonstrate significant correlations with optimism during any of the challenge tasks in the total sample ($N = 39$) (Tables 9.c. and 9.d.). However, patients in the non-surgical group demonstrated a positive correlation between optimism and Mean NN ($r=0.59$, $p=.05$) during the mental arithmetic task, while the surgically corrected patients demonstrated a significant relationship between optimism and RMSSD ($r=-0.48$, $p=.05$) during the mirror trace task.

To examine these results further, exploratory analyses were conducted using hierarchical linear regression models for the 5 heart rate variability measures that demonstrated the strongest correlations with optimism in at least one of the groups during the various tasks (Tables 9.c. and 9.d.). The 5 HRV variables included Mean NN reactivity during the metal arithmetic and the mirror trace tasks, RMSSD reactivity during the mirror trace task, LF during the cold pressor task, and HF during the mirror trace task. The first step of the hierarchical linear regression model examined the effect of group status (surgically corrected or non-surgical CHD); the second set examined the effect of optimism; and the third set examined the interaction between optimism and group status. Of the 5 regression models conducted for the heart rate variability measures, none revealed a significant relationship between optimism and HRV reactivity (supplementary tables S15 through S19). Despite the relatively large

differences observed in the correlations between the groups (see Table 9.c. and 9.d.), group status was only significantly related to mean NN during the mental arithmetic task ($R^2 \text{ Change}_{\text{group}} = 0.16$; $F = 5.80$; $p = 0.02$; see supplementary table S15), and optimism added to the prediction of RMSSD during the mirror trace task ($R^2 \text{ Change}_{\text{group}} = 0.13$; $F = 4.58$; $p = 0.04$; see supplementary table S15), but none of the optimism x group-status interactions were significant.

To examine the role of family environment, the FES was added to the aforementioned models to examine whether the previous findings were influenced by family environment. The fully adjusted model included step 1 family environment; step 2 group status; step 3 optimism (CASQ); and step 4 the interaction between optimism and group status. Results revealed that family environment did not contribute significantly any of the HRV regression models (see Tables 11.a. through 11.e.). Although family environment itself did not significantly add to the overall model, controlling for this variable did effect the relationship between Mean NN during mental arithmetic and optimism, such that when family environment was included in the model optimism became significantly associated with Mean NN during the mental arithmetic task ($R^2 \text{ Change}_{\text{Optimism}} 0.24$; $F \text{ Change} = 4.19$; $p = 0.05$) (Table 11.a.).

In summary, analyses examining the associations between optimism with hemodynamic reactivity and HRV-derived vagal tone demonstrated fairly consistent nonsignificant findings. Thus, these findings suggest that although optimism may play a role in emotional functioning in children with congenital

heart defects (Hypothesis 1), optimism does not appear to influence cardiovascular reactivity to mental or physical challenges.

Hypothesis 2(b): The association between optimism and reduced cardiovascular reactivity will be mediated by individual distress levels among children with congenital heart defects. These associations are anticipated to remain significant when adjusting for measures of family environment.

The criteria for mediational pathways were not met because optimism was not significantly related to reduced hemodynamic or HRV reactivity (Table 9). To nonetheless explore potential mediational models, the 3 child distress measures found to be significantly related to optimism were added to the aforementioned models. The mirror trace task appeared to have elicited the most consistent correlations among optimism and the cardiovascular variables. Therefore the 5 cardiovascular measures obtained during the mirror trace task were used to test this portion of the mediational model. The 3 child distress variables included Behavioral Symptom Index (parent rating), externalizing symptoms (parent rating), and anxiety (parent rating). The 5 cardiovascular outcome measures include SBP, DBP, HR, LF, and HF during the mirror trace task. Thus, 15 exploratory mediational model regressions were conducted. Each model included step 1 family environment; step 2 child distress; step 3 group status; step 4 optimism (CASQ); and step 5 interaction between optimism and group status.

Results of the 15 regression models did not support the hypothesis that individual distress mediated the relationship between optimism and cardiovascular reactivity (supplementary tables S23-S36). This was consistent with the non-significant relationship between optimism and cardiovascular reactivity in the previous models. The previously demonstrated relationship with DBP and FES, however, continued to be significant in the mediational regression models ($R^2 \text{ Change}_{\text{FES}} = 0.25$; $F = 9.47$; $p < 0.01$; see supplementary tables S24, S29, and S34), while the relationship between SBP and FES was marginally significant ($R^2 \text{ Change}_{\text{FES}} = 0.11$; $F = 3.63$; $p < 0.07$; see Tables S23, S28, and S33). Interestingly, a previously undemonstrated relationship between optimism and HF HRV during the mirror trace task was revealed after controlling for parent rated child anxiety ($R^2 \text{ Change}_{\text{optimism}} = 0.36$; $F = 2.81$; $p < 0.05$; see Table 12). Despite this one promising result, optimism did not significantly contribute in 14 of the 15 mediational regression models examining distress, family environment and optimism as predictors of hemodynamic and HRV reactivity.

DISCUSSION

1. Summary and Implications of Study Findings

The present study examined the relationships between optimism, child distress, and cardiovascular reactivity. The findings of the present study did partially support an association between optimism and child distress levels. The

present study also partially replicated previous research by demonstrating significant relationships between family environment and the child's self-rated anxiety levels but not with self-rated depression or distress. Consistent with previous research, the challenge tasks of the mental arithmetic, computer game, mirror trace, and cold pressor elicited the expected cardiovascular reactivity for SBP, DBP, and HR. Regarding HRV measures, only the cold pressor task consistently produced a response that significantly differed from the baseline levels. The cardiovascular reactivity and heart rate variability responses did not reveal the expected associations with optimism (Hypothesis 2).

II. The Relationship between Optimism and Child Distress

Correlations between optimism and parent and child rated distress levels were in the expected direction, but not consistently significant for all measures of distress. The first hypothesis was therefore partially confirmed. Significant negative correlations between optimism and parent rated behavioral symptoms, externalizing symptoms, and anxiety were found. However, associations with parent-rated internalizing symptoms or depression levels were not significant. Furthermore, child-rated measures of behavioral symptoms, internalizing symptoms, externalizing symptoms, depression and anxiety did not demonstrate significant relationships with optimism. Although associations between optimism and behavioral symptoms, externalizing symptoms, and anxiety were consistent with previous research, this study did not detect significant relationships between

optimism and internalizing behaviors and depression, as has been demonstrated in other studies (Carver et al., 1987; Hummer, Dember, Melton, & Schefft, 1992; Nolen-Hoeksema, Girgus, & Seligman, 1991; Nolen-Hoeksema, Girgus, & Seligman, 1986; Peterson & Seligman, 1984; Seligman, 1984; Seligman, Castellon, Cacciola, & Schulman, 1988; Utens et al., 1993; Utens et al., 1994). This study also did not replicate the findings of Fredrickson et al., (2004) who found that children with CHD have more internalizing problems than healthy children, yet have similar levels of externalizing problems.

Optimism scores of participants in the current study appear to be similar to optimism scores published in other studies conducted with healthy participants. Mean CASQ score in this sample was 6.86 ± 4.5 which is comparable to normative scores in healthy children which ranged from 6.25 ± 3.02 , (Nolen-Hoeksema, et al. 1992) to 6.94 ± 39.1 (Seligman et al., 1984). Similarly, scores of family environment obtained in this sample did not differ from FES norms for healthy families. Mean FES scored in this study was 14.63 ± 1.81 while published norms report a mean score for normal families of 13.84 ± 2.39 . With the CASQ and FES scores being in the normal range, it is not surprising that the childr distress ratings also fall within the normal range. Scores for the BASC indecies and subscales are reported in T scores with T-score of 41-59 indicating average level, while T score of 60 is considered at risk with a score of 70 or higher considered clinically significant. T scores obtained in the present study ranged from 48.58 ± 7.38 to $52.35 + 6.41$ (see Table 3). Although it is encouraging that children with CHD in this sample so closely resembled healthy

children with respect to optimism levels, family stress, and child distress, this is inconsistent with previous research. It is possible that the mental health measures reflect that these children had been successfully treated for their CHD and were relatively asymptomatic at the time of the study.

This study did partially replicate previous research by finding a significant relationship between family environment and optimism (Mcsteen, 1997), and family environment and SBP and DBP reactivity. However, no relationships were found between family environment and other indicators of child distress such as internalizing symptoms, externalizing symptoms, depression, anxiety, Nor were such associations found between family environment and HRV. Further, as expected there were no differences between the groups with respect to optimism levels, distress level, or family environment.

It is interesting that parent-rated distress demonstrated significant correlations with optimism whereas child-rated distress did not. There are several factors that may explain the seemingly discrepant findings. First, parent rated scores were higher for behavioral symptoms, externalizing symptoms, and anxiety and lower for internalizing symptoms and depression. This may be simply because the behavioral, externalizing symptoms and anxiety are more observable to the parents, while internalizing symptoms and depression are less visible and the parents may be unaware of the extent to which their child may be experiencing them. With regard to child rated measures of distress, given the age of the children involved, many of the participants may not have been old enough to have insight into their behavior, they may have been trying to respond

in a socially desirable manner, or they may have been concerned that their parents would see their responses and therefore tailored the responses to avoid raising parental concern. Therefore, Hypothesis 1 was partially confirmed by the correlations with optimism and several of the child distress measures suggesting that optimism may play a role in decreasing child distress at least as observed by their parents.

III. The Role of Optimism in Cardiovascular Reactivity to Mental and Physical Challenge Tasks

Cardiovascular responses were examined for SBP, DBP, and HR during the mental and physical challenge tasks. Although there was no evidence for a relationship between optimism and reduced hemodynamic reactivity for the total sample (Hypothesis 2), inspection of the simple effects revealed a few interesting trends. HR and optimism were positively correlated in the surgically corrected participants and negatively correlated in the non-surgical participants implying that the variable of optimism may not uniformly bestow health benefits in patients with surgically corrected CHD. These results stratified by groups status need to be interpreted with caution because the interaction between group status and optimism was not significant.

IV. The Role of Optimism in HRV Reactivity to Mental and Physical Challenge Tasks

Significant relationship between optimism and the altered HRV responses were generally not observed in the current investigation. Patients in the non-surgical group demonstrated positive correlations between optimism and mean NN (i.e., lower HR) during the mental arithmetic task, and patients with surgically corrected CHD demonstrated a positive correlation between optimism and RMSSD. The analyses of Mean NN during baseline as well as during the challenge tasks revealed differential results based on group status such that Mean NN and optimism were positively correlated (the expected direction) in the non-surgical group (pearson r correlations ranged between 0.43 to 0.61) while negatively correlated with the surgically corrected group (correlations ranged between -0.25 to -0.31). A similar trend is revealed upon examination of the RMSSD such that optimism was positively correlated (expected direction) in the non-surgical group (correlations ranged between 0.04 to 0.31) while negatively correlated with the surgically corrected group (correlations ranged between -0.20 to -0.48). These results may reflect type I error given the numerous analyses conducted, but these effects may indicate that an underlying relationship between optimism and autonomic nervous system dysregulation may exist in subgroups of CHD patients.

Interestingly comparison of HRV measures reported in other studies was difficult because data were presented in numerous ways. First, many studies conducted 24 hour recordings and analysed the data of a 24 hour period, and the values obtained from averages of 24 hour measures are not numerically

equivalent to those obtained over shorter durations. Second, standardized methods of measuring and reporting measures of HRV are relatively recent and earlier studies vary widely in methods of reporting. Some studies reported Z-scores, others reported a variety of index scores, or log transform scores. Thus direct comparison between the values obtained in the present study and many of the previous studies was not statistically appropriate. However, in the study that most closely resembled the current study (Bia et al, 1989) values obtained in the current investigation appear consistent with previous research. Specifically mean NN, measured at rest in post-operative children with CHD was 739 ± 48.7 , for healthy controls was 702 ± 72.4 and values obtained in the current study mean NN was 718.67 ± 154.61 . Again the values for current study participants falling between post-operative CHD patients and healthy controls likely reflects that the current participants were asymptomatic and had no functional limitations at the time the study was conducted.

V. Limitations of the Current Study

a. Sample Size and Power

One of the major limitations of this study is the relatively small sample size. While the study attempted to predict the required number of participants adequately detect a small effect size (Pearson correlations of $r=.25$), most the actual effect sizes were smaller. Using the actual data collected during this study, post hoc power analyses conducted on the individual variables revealed

that the present study was considerably under powered. Power for the child distress model examined in H1 ranged between 17%-84% with only one variable being sufficiently powered at greater than 80%. Similarly, power for the hemodynamic relationships examined in H2a ranged between 14%-89% for the hemodynamic variables and 24-78% for the HRV variables with only 3 variables being sufficiently powered at greater than 80%. Given the data that was collected, this study would have needed to run approximately 93 participants to have adequate power to detect relationships among this study variables given the observed effect sizes.

Another factor that may have interfered with the statistical analyses of the present findings is the relatively large variability of the hemodynamic and HRV measures. Variability may in part reflect the effects of age and sex. For example, the mean SPB and DBP for an average 6 year old girl is 94/56 while the average for a large 12 year old boy is 110/64 (National Heart, Lung, and Blood Institute at the National Institute of Health, 2009). Another source of variability in was the inclusion of children with numerous diagnoses representing a variety of congenital structural defects. Although current cardiac dysfunction was required to be mild for participation in the study, regardless of initial disease severity, other research has demonstrated that many of the patients included in our sample may continue to have subtly compromised cardiac function, specifically residual suppressed HRV (Massin and von Bernuth, 1988). Attempts to decrease the variability in the data included using difference scores for the hemodynamic variables and logarithmically transformed data for selected HRV variables.

Additional analyses of the data stratifying by age, or CHD diagnosis were considered but given the small sample size, such analyses would not likely yield significant results.

One of the major strengths of this study was the multi-method, multi-task design, but the number of analyses performed with these data increases the possibility of Type I error. Given the consistency identified in the trends in the results, the unusually high variability in the dependent variables and the inadequate power, this study is probably more vulnerable to Type II error than Type I error.

b. Design

The comparison groups used in this investigation only included children who had a diagnosis of CHD. The children were assigned to groups based on whether they had received surgical intervention to treat the CHD diagnosis, or not. All children included in the study were currently asymptomatic or mildly symptomatic regardless of initial CHD treatment received. The non-surgical intervention group was intended to allow for comparison of differences in the study variables based on underlying disease severity. Although it is useful to compare how study variables affect children with more severe forms of CHD (required surgical intervention) with children with less severe CHD (did not require surgical intervention), comparing both of the groups with healthy children is also of clinical interest. Because of Department of Defense regulations, healthy

children can only be included in research if there is a direct benefit to them for participating. As this was not the case with the current study, a group of healthy children could not be included for comparison. Not having a healthy control group limits the conclusions that can be drawn from this study specifically regarding the clinical significance of optimism. General comparison with data from healthy children published in other research can be made, but as study characteristics vary greatly, definitive conclusions are inappropriate. Including a healthy control group would have allowed us to draw more accurate conclusions regarding the relative importance and role of optimism, disease severity, and autonomic function.

Another potential limitation of the current design was the use of short duration measurement of HRV reactivity. Although, measurement of SBP, DBP, and HR changes as a result of 5 minute challenge tasks is well validated in the research, short duration HRV measurements are less frequently studied. In children with CHD, previous research has studied ambulatory HRV over a 24 hour period, almost exclusively. Given that duration of measurement critically impacts the values obtained in HRV measures, measures obtained over different durations can not be meaningfully compared. Therefore, it is unknown whether the short duration HRV measurement used in the current study is as valid as the more established 24 hour HRV measures.

An additional limitation to the design of the study was the lack of control for age and gender in the current study. Previous research has demonstrated that there are age and gender differences in both optimism levels and the

magnitude of hemodynamic response. Specifically, boys have a more pessimistic attributional style than girls do prior to puberty but have a less pessimistic attributional during adolescence (Nolem-Hoesema, 1991). Matthews & Stoney (1988) found that boys have increased magnitude of hemodynamic response to stressors than age matched girls and that magnitudes of hemodynamic response increased with age (Matthews & Stoney, 1988). The present investigation was unable to enroll an adequate number of participants to statistically observe age or gender differences or control for this possible influence on the study results.

A final design limitation was that social support was not controlled for in this investigation. Previous research demonstrates that having a supportive person present during mental challenge tasks attenuates hemodynamic response to the task (Choen & Hoberman, 1983; Uchino et al., 1996). In the present investigation, parents were allowed to be present while the children completed the challenge tasks but were not required to do so. The parent and child made the decision of whether the parent remained in the room throughout the protocol, but this was not recorded in the present investigation. The presence of a supportive parent may have impacted the hemodynamic response of the child and may have affected the observed results of the this investigation. Future studies should statistically control for this possibly confounding factor.

c. Concerns Related to Participant Enrollment

The initial study plan was to obtain 50 children and 50 parents to participate, 25 each per group. However, several factors resulted in lower recruitment than planned and the study was switched to a timeline for completion as opposed to a specific number of participants. As a result 39 children and 39 parents participated which was only 78% of our original recruitment goal. The main factors that contributed to the relatively slow recruitment was reluctance of parents to enroll their children in a research study and the inconvenience of scheduling participation in the study, particularly for patients who lived at a distance from the clinic. Many parents declined to participate in the study because their child already had numerous doctor visits and they were unwilling to add a visit that was not absolutely necessary. Several parents also indicated that it was inconvenient to travel to the hospital, take their children out of school, or schedule the appointment during the day. Efforts were made to minimize the inconvenience by scheduling the study visit for the same day that the child was scheduled for his/her annual assessment physical with the pediatric cardiologist. Effort was also made to schedule as many study visits as possible during spring, summer, and winter breaks. Although, these efforts were helpful, the inability to conduct the tests after regular clinic hours and on weekends limited the ability/interest of many families to participate. Eligible children were identified by their pediatric cardiologist as they approached the time of their annual check-up. Families that were interested in participating were given the opportunity to schedule the study visit to coincide with their annual check-up as well as during school breaks. Recruiting for the study was discontinued after 15 months

because it was determined that most eligible families had been identified and given ample opportunity to participate. It was determined that most eligible children had been contacted at the time of their annual physical and as recruitment had encompassed an entire year, it was considered unlikely that a sufficiently large group of additional eligible participants would be identified. Future studies may need to consider assessments during weekends or evaluations of mental and physical stress responses using devices that can be taken to the patients' home and/or ambulatory monitoring techniques.

d. Concerns Related to Generalizability:

The opportunity to conduct the present study at Walter Reed Army Medical Center limited the eligible patient population to beneficiaries (i.e. family members) of active duty or retired military members. The results of the current study may not be generalizable to children with CHD of non-military families. First, military beneficiaries have virtually unlimited access to specialized health care to ensure optimal treatment and prognosis for the child. Second, this medical treatment is free of charge, this not only increases the probability that families will utilize their health care resources, but also eliminates the financial stress that non-military families may face when coping with chronic illness. Therefore participants in this study have probably received better medical treatment and have potentially less overall family distress than other families of children with CHD.

A further concern to the generalizability of these results is that many of the participants had at least one stay at home parent. One drawback to conducting the study within WRAMC facilities was that the researchers did not have access to the clinic on weekends. As a result of this, many of the participants were brought in for the study by a non-working parent. The lack of weekend hours may have unintentionally excluded children in families with 2 working parents, or single parent families. Given that family environment is known to affect cardiac function in children with CHD, this selection bias may further restrict the generalizability of these results.

Another potential limitation of the current investigation is the use of asymptomatic uncorrected CHD patients as the control group. Federal and DoD guidelines do not allow healthy control groups in pediatric studies if there is no direct benefit related to the study participant, therefore asymptomatic patients with uncorrected CHD were used as a comparison group. Although, these children were asymptomatic, they were still under the care of a physician to monitor progress. These children may also continue to have residual cardiovascular symptoms; therefore any differences between the groups may underestimate the actual differences between children with CHD versus healthy children.

VI. Clinical Implications

Although larger studies, replication, and further research in this area are needed, the relationships between optimism and distress and cardiovascular

responsiveness to an acute stressor observed in this investigation may have important clinical implications for children with CHD. Previous work in this area has been conducted primarily with healthy individuals. The results in CHD patients demonstrated in the present study provide important information on the generalizability of previous results found in healthy children to children with CHD. Specifically, the current study found that optimism levels, child distress, and family stress was consistent with levels found in studies of healthy children. This is encouraging, but must be interpreted cautiously because children who continued to have functional limitations following their CHD treatment were excluded from this study, and therefore our findings may not apply to children with more severe CHD. By providing preliminary findings for children with CHD, interventions may be tailored to the specific outcome measures most salient to CHD patients. Although optimism interventions have demonstrated ability to increase optimism scores in healthy adolescents (Shatte, Gillham, Reivich, & Seligman, 1994; Gillham, Reivich, Jaycox, & Seligman, 1995; Chang, 2001) and breast cancer patients (Antoni, 2001) research of specific optimism interventions in chronically ill children is currently lacking. The wealth of research demonstrating improved emotional outcome in optimistic individuals implies that reducing child distress in chronically ill patients may be beneficial. Incorporating an optimism intervention into existing education and treatment regimens may help not only children with CHD, but their parents as well. Data from this study further suggest that optimism-promoting interventions are likely to have their primary beneficial effects on quality of life and that such interventions are less

likely to positively affect hemodynamic and autonomic nervous system measures.

VII. Future Directions

The findings from the present study suggest a need for more research on optimism, quality of life, and cardiovascular function in children with CHD. Future research needs to include larger sample sizes and a more diverse population (including non-military families), to more thoroughly explore the relationship between these variables and increase the generalizability of the results. Efforts aimed at stratifying by age, sex, and CHD diagnosis may reveal more sensitive evaluations of the proposed relationships between optimism and psychological as well as cardiovascular outcome measures.

Post-stress hemodynamic recover has been shown to be an important index of cardiovascular function. Post-stress recovery is defined as changes in the stressor-induced responses following the termination of the stressor. Although magnitude of physiological response to a stressor is the most common parameter in assessment of stressor effects, post-stress physiological recovery provides an additional perspective of ANS function. Research demonstrates that post-stress recovery is inversely related to magnitude of stress response, the primary mechanism of recovery time appears to be the reuptake of catecholamines and is clinically significant marker of ANS function. Post-stress recovery of hemodynamic variables is emerging as an important indicator of

cardiac outcome and future research in children with CHD should include this valuable measure of ANS function.

A limitation of laboratory investigations of cardiovascular response to challenge is lack of opportunity to assess the frequency of the stress response as it occurs in daily life settings. It may be that optimistic individuals have a higher threshold for activation of the stress response, and therefore, cardiac benefits may not only be related to the magnitude of the stress response, but also to the frequency of its activation. Future studies may seek to further investigate the present hypotheses using ambulatory methods in both healthy and diseased populations to accurately quantify participants' frequency of stress experiences. Research may also need to address the extent to which laboratory-based biobehavioral measures predict responses to challenges and hassles in daily life settings.

Another critical direction for future research is examining the effects of disease severity on fluctuations in optimism. It is known that optimism levels may undergo changes or fluctuations as an individual progresses through childhood and early adulthood. It is unknown, however, how individual's optimism levels are affected as they progress through stages of chronic illness. Although, there have been prospective studies demonstrating that optimism level predicts future morbidity and mortality (Kubzansky et al., 2001; Scheier and Carver, 1989, 1999; Hegelson, 1999, 2003; Giltay, 2001, 2006), these studies have only assessed optimism at one time point, either while the individuals were still disease free, or following and throughout a diagnosis of a chronic illness. Very

few studies have assessed optimism at multiple points of time. It is reasonable to assume that optimism scores do systematically fluctuate as one's life circumstances change. If optimism scores do tend to vary over the course of an individual's lifetime, it would be beneficial to document these fluctuations in healthy individuals as well as individuals diagnosed with a chronic illness.

Finally, future research may focus on other pathways by which optimism can cause health benefits. There are a wide range of related variables that possess similar relationships with optimism, with regard to their impact on health. Continuing scrutiny of variables such as family environment, coping style, self efficacy, depression, social support, adherence to medical regimen, and engagement in health behaviors could serve to increase understanding of the causal mechanisms and enhancing cardiac function in this population that is especially vulnerable to additional cardiovascular disease in adulthood. This information will be very beneficial in determining the nature of and developing appropriate psychological interventions for children with CHD and their families.

Tables

Table 1: Sample Characteristics

| | Corrected CHD (N=24) | Uncorrected CHD (N=15) | F or χ^2 | p |
|---|---------------------------------------|------------------------------------|------------------------------------|-----------------|
| Male | 14 (58.3%) | 8 (53.3%) | $\chi^2 = 0.64$ | 0.42 |
| Caucasian | 15 (62.5%) | 12 (80%) | | |
| African American | 6 (25%) | 2 (13.3%) | | |
| Asian American | 1 (4.2%) | 1 (6.7%) | | |
| Other | 2 (8.4%) | 0 | | |
| Age years (SD) | 9.1 \pm 2.2 | 8.7 \pm 2.0) | F = 0.32 | 0.58 |
| BL SBP (SD) | 96.66 \pm 8.67 | 93.25 \pm 17.83 | F = 0.59 | 0.45 |
| BL DBP (SD) | 55.75 \pm 7.82 | 58.41 \pm 13.73 | F = 0.55 | 0.46 |
| BL HR (SD) | 77.73 \pm 15.81 | 88.96 \pm 15.86 | F = 4.31 | 0.046 * |
| Miss greater than 5 days of school per year | 9 (41.7%) | 4 (26.7%) | $\chi^2 = 35.82$ | 0.000** |
| Number of surgeries for CHD (SD) | 1.68\pm1.04 | 0 | | |
| Number of days hospitalized for CHD (SD) | 39.87 (\pm59.61)* | 0.64 (\pm1.15) | F = 5.99 | 0.02 |
| Children taking medication (all reasons) | 8 (33.3%) | 7 (46.7%) | F = 0.89 | 0.35 |
| Percent children taking heart medication | 3 (12.6%) | 0 (0%) | F = 2.03 | 0.16 |
| Percent Children who had feeding difficulties | 8 (34.8%) | 3 (20%) | $\chi^2 = 34.37$ | 0.000 ** |
| Family Environment Scale (SD) | 14.39 \pm 1.85 | 15.0 \pm 1.73 | F = 1.03 | 0.32 |

Note: CHD = Congenital Heart Disease; BL SBP=Baseline Systolic Blood Pressure; BL DBP=Baseline Diastolic Blood Pressure; BL HR=Baseline Heart Rate; * p.<.05, ** p < 0.01 compared to patients with uncorrected CHD

**** H1 ****

Table 2: Optimism Test Scores as Related to CHD group status

| | Corrected CHD | | Uncorrected CHD | |
|---------------------|---------------|-------|-----------------|-------|
| | (N=24) | | (N=15) | |
| | Mean | ± SD | Mean | ± SD |
| CASQ Total | 6.93 | ±4.81 | 6.77 | ±4.33 |
| CASQ Positive Items | 13.67 | ±3.06 | 14.17 | ±2.58 |
| Total | | | | |
| CASQ Negative Items | 6.74 | ±3.25 | 7.40 | ±2.49 |
| Total | | | | |
| YLOT | 0.0 | ±3.21 | -1.00 | ±2.83 |

CHD = Congenital Heart Disease; CASQ=Children's Attributional Style Questionnaire; YLOT=Youth Life Orientation Test

Table 3: Child Distress, Behavioral and Psychological Characteristics

| | Total Sample | | Corrected CHD | | Uncorrected CHD | |
|---|--------------|---------|---------------|--------|-----------------|---------|
| | (N=39) | | (N=24) | | (N=15) | |
| | Mean | ± SD | Mean | ± SD | Mean | ± SD |
| BSI (child rating) | 48.58 | ± 7.38 | 48.31 | ± 7.16 | 49.00 | ± 8.02 |
| BSI (parent rating) | 50.13 | ± 12.48 | 49.57 | ± 9.82 | 51.00 | ± 16.08 |
| BASC-comp-C (child rating) | 52.35 | ± 6.41 | 53.11 | ± 5.62 | 51.17 | ± 7.60 |
| BASC-comp-Internalizing-P (parent rating) | 49.16 | ± 10.38 | 48.67 | ± 9.57 | 49.87 | ± 11.83 |
| BASC-comp-Externalizing-P (parent rating) | 47.55 | ± 10.44 | 46.70 | ± 8.25 | 48.87 | ± 13.35 |
| Anxiety (child rating) | 49.31 | ± 9.44 | 49.95 | ± 8.73 | 48.25 | ± 10.84 |
| Anxiety (parent rating) | 49.21 | ± 11.05 | 49.78 | ± 9.57 | 48.33 | ± 13.32 |
| Depression (child rating) | 48.91 | ± 8.82 | 47.60 | ± 7.37 | 51.08 | ± 10.82 |
| Depression (parent rating) | 46.76 | ± 8.56 | 45.13 | ± 6.57 | 49.26 | ± 10.71 |

Note: CHD = Congenital Heart Disease; BSI-C =Behavioral Symptom Index Child's Rating; BSI-P =Behavioral Symptom Index Parent's Rating; BASC-Comp-C = Behavior Assessment Scale for Children Composite Score Child's Rating; BASC-Comp-Internalizing-P=Behavior Assessment Scale for Children Composite Score for Internalizing Behaviors Parent's Rating; BASC-Comp-Externalizing-P=Behavior Assessment Scale for Children Composite Score for Externalizing Behaviors Parent's Rating

Table 4a: Correlations Between Child Distress Level (Parent rating) and Optimism

| | Total Sample (N=39) | | Corrected CHD (N=24) | | Uncorrected CHD (N=15) | |
|--|-------------------------|------|--------------------------|------|----------------------------|------|
| | Correlation | | Correlation | | Correlation | |
| | CASQ | YLOT | CASQ | YLOT | CASQ | YLOT |
| BSI-P (parent rating) | -.45** | -.18 | -.40 | -.02 | -.54* | -.31 |
| BASC-comp- Internalizing-P (parent rating) | -.27 | -.40 | -.26 | -.61 | -.28 | .26 |
| BASC-comp- Externalizing-P (parent rating) | -.50** | -.45 | -.53** | -.48 | -.50* | -.40 |
| Anxiety (parent rating) | -.36* | .24 | -.24 | .36 | -.51* | .14 |
| Depression (parent rating) | -.15 | -.22 | -.18 | -.24 | -.13 | -.10 |

Note: CHD = Congenital Heart Disease; BSI-C =Behavioral Symptom Index Child's Rating; BSI-P =Behavioral Symptom Index Parent's Rating; BASC-Comp-C = Behavior Assessment Scale for Children Composite Score Child's Rating; BASC-Comp-Internalizing-P=Behavior Assessment Scale for Children Composite Score for Internalizing Behaviors Parent's Rating; BASC-Comp-Externalizing-P=Behavior Assessment Scale for Children Composite Score for Externalizing Behaviors Parent's Rating; CASQ = Child Attributional Style Questionnaire; YLOT = Youth Life Orientation Test* = p<.05, **=p<0.01

Table 4b: Correlations Between Child Distress Level (Child rating) and Optimism

| | Total Sample (N=39) | | Corrected CHD (N=24) | | Uncorrected CHD (N=15) | |
|----------------------------|-------------------------|------|--------------------------|------|----------------------------|------|
| | Correlation | | Correlation | | Correlation | |
| | CASQ | YLOT | CASQ | YLOT | CASQ | YLOT |
| BSI-C (child rating) | -.36 | .23 | -.44 | -.37 | -.27 | .72 |
| BASC-comp-C (child rating) | .15 | .24 | .37 | .43 | -.05 | .04 |
| Anxiety (child rating) | -.18 | .46 | -.26 | .12 | -.09 | .86 |
| Depression (child rating) | -.19 | .06 | -.13 | -.24 | -.26 | .61 |

Note: CHD = Congenital Heart Disease; BSI-C =Behavioral Symptom Index Child's Rating; BSI-P =Behavioral Symptom Index Parent's Rating; BASC-Comp-C = Behavior Assessment Scale for Children Composite Score Child's Rating; BASC-Comp-Internalizing-P=Behavior Assessment Scale for Children Composite Score for Internalizing Behaviors Parent's Rating; BASC-Comp-Externalizing-P=Behavior Assessment Scale for Children Composite Score for Externalizing Behaviors Parent's Rating; CASQ = Child Attributional Style Questionnaire; YLOT = Youth Life Orientation Test* = $p < .05$, **= $p < 0.01$

Table 5: Correlations Between Child Distress Levels and Family Environment

| | Total Sample (N=39) | Corrected CHD (N=24) | Uncorrected CHD (N=15) |
|--|-------------------------|--------------------------|----------------------------|
| | Correlation | Correlation | Correlation |
| | FES | FES | FES |
| BSI-C (self rating) | -0.17 | -0.24 | -0.07 |
| BSI-P (parent rating) | -0.07 | -0.15 | .01 |
| BASC-comp-C (self rating) | -0.24 | -0.29 | -0.15 |
| BASC-comp- Internalizing-P (parent rating) | 0.01 | -0.04 | 0.01 |
| BASC-comp- Externalizing-P (parent rating) | 0.01 | -0.07 | 0.06 |
| Anxiety (self rating) | -0.40* | -0.53* | -0.21 |
| Anxiety (parent rating) | -.22 | -0.15 | -0.29 |
| Depression (self rating) | -0.08 | -0.15 | -0.04 |
| Depression (parent rating) | 0.15 | 0.11 | 0.13 |
| CASQ | 0.18 | 0.19 | 0.17 |
| YLOT | -0.46 | -0.37 | -0.65 |

Note: CHD = Congenital Heart Disease; BSI-C =Behavioral Symptom Index Child's Rating; BSI-P =Behavioral Symptom Index Parent's Rating; BASC-Comp-C = Behavior Assessment Scale for Children Composite Score Child's Rating; BASC-Comp-Internalizing-P=Behavior Assessment Scale for Children Composite Score for Internalizing Behaviors Parent's Rating; BASC-Comp-Externalizing-P=Behavior Assessment Scale for Children Composite Score for Externalizing Behaviors Parent's Rating; CASQ = Child Attributional Style Questionnaire; YLOT = Youth Life Orientation Test* = p<.05, **=p<0.01

Table 6.a. The Role of Family Environment in the Association between Optimisim and Behavioral Symptoms (BSI Parent Rating)

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|-----|--------------------------|-------------|------------------------|
| Family Environment | .00 | .07 | .79 | .00 | .07 | .79 |
| Group status | .01 | .08 | .92 | .00 | .09 | .77 |
| Optimism | .19 | 2.38 | .09 | .19 | 6.96 | .01** |
| Group x Optimism Interaction | .119 | 1.73 | .17 | .00 | .01 | .98 |

Note: BSI-P =Behavioral Symptom Index Parent's Rating; * = p<.05, **=p<0.01

Table 6.b. The Role of Family Environment in the Association between BASC-Comp-Externalizing (Parent Rating)

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|-----|--------------------------|-------------|------------------------|
| Family Environment | .00 | .03 | .86 | .00 | .03 | .86 |
| Group status | .01 | .10 | .91 | .01 | .16 | .70 |
| Optimism | .24 | 3.16 | .04 | .23 | 9.24 | .01** |
| Group x Optimism Interaction | .24 | 2.31 | .08 | .00 | .05 | .82 |

Note: BASC-Comp-C-Externalizing = Behavior Assessment Scale for Children Composite Score Child's Rating; * = $p < .05$, ** = $p < 0.01$

Table 6.c.: Role of Family Environment in the Association between Child Anxiety Levels (Parent Rating)

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|-----|--------------------------|-------------|------------------------|
| Family Environment | .05 | 1.52 | .23 | .05 | 1.52 | .23 |
| Group status | .05 | .76 | .46 | .00 | .05 | .83 |
| Optimism | .13 | 1.53 | .23 | .09 | .2.98 | .09 |
| Group x Optimism Interaction | .15 | 1.26 | .31 | .01 | .49 | .49 |

Note: * = $p < .05$, ** = $p < 0.01$

Table 7: Acute Emotional Reactivity Response to Mental Challenge Tasks and Cold Pressor

| | | Total Sample | | Corrected CHD | | Uncorrected CHD | |
|------------|----|--------------|--------|---------------|--------|-----------------|--------|
| | | (N=39) | | (N=24) | | (N=15) | |
| | | Mean | ± SD | Mean | ± SD | Mean | ± SD |
| Liked | MA | 2.23 | ± 1.59 | 2.91 | ± 1.63 | 2.47 | ± 1.55 |
| | CG | 4.71 | ± 0.75 | 4.57 | ± 0.93 | 4.93 | ± 0.27 |
| | MR | 3.08 | ± 1.50 | 3.32 | ± 1.59 | 2.73 | ± 1.33 |
| | CP | 2.47 | ± 1.57 | 2.58 | ± 1.64 | 2.27 | ± 1.49 |
| Annoyed | MA | 2.60 | ± 1.55 | 2.27 | ± 1.39 | 3.07 | ± 1.71 |
| | CG | 1.57 | ± 1.07 | 1.57 | ± 1.08 | 1.57 | ± 1.09 |
| | MR | 2.70 | ± 1.54 | 2.32 | ± 1.39 | 3.27 | ± 1.62 |
| | CP | 3.10 | ± 1.69 | 3.95 | ± 1.58 | 3.36 | ± 1.91 |
| Interested | MA | 2.65 | ± 1.51 | 3.00 | ± 1.51 | 2.13 | ± 1.41 |
| | CG | 4.60 | ± 1.95 | 4.43 | ± 1.16 | 4.86 | ± 0.36 |
| | MR | 3.14 | ± 1.57 | 3.32 | ± 1.46 | 2.87 | ± 1.73 |
| | CP | 2.47 | ± 1.46 | 2.58 | ± 1.46 | 2.27 | ± 1.49 |

MA=Mental Arithmetic CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = $p<.05$, **= $p<0.01$

Table 8.a: Baseline and Peak Hemodynamics in CHD Patients in Response to Mental Challenge Tasks and Cold Pressor

| | | All Participants (N=39) | | Corrected CHD (N=15) | | Uncorrected CHD (N=24) | |
|-----|----|----------------------------|-----------------|-------------------------|-----------------|---------------------------|-----------------|
| | | Baseline | Peak | Baseline | Peak | Baseline | Peak |
| SBP | MA | 96.48 ± 11.76 | 103.94 ± 16.86* | 97.08 ± 8.98 | 104.20 ± 16.55* | 93.33 ± 17.19 | 103.57 ± 17.91* |
| | CG | 96.48 ± 11.76 | 104.21 ± 12.41* | 97.08 ± 8.98 | 106.10 ± 12.49* | 93.33 ± 17.19 | 101.31 ± 12.19* |
| | MR | 96.48 ± 11.76 | 108.83 ± 14.01* | 97.08 ± 8.98 | 110.30 ± 13.62* | 93.33 ± 17.19 | 106.87 ± 14.74* |
| | CP | 96.48 ± 11.76 | 101.66 ± 17.65* | 97.08 ± 8.98 | 103.37 ± 17.92* | 93.33 ± 17.19 | 99.15 ± 17.66* |
| DBP | MA | 96.29 ± 11.89 | 60.76 ± 9.95* | 55.68 ± 8.21 | 59.20 ± 7.46* | 58.35 ± 13.23 | 63.15 ± 12.87* |
| | CG | 96.29 ± 11.89 | 63.55 ± 7.69* | 55.68 ± 8.21 | 64.30 ± 5.79* | 58.35 ± 13.23 | 62.38 ± 10.12* |
| | MR | 96.29 ± 11.89 | 64.40 ± 12.09* | 55.68 ± 8.21 | 65.80 ± 10.53* | 58.35 ± 13.23 | 62.53 ± 10.07* |
| | CP | 96.29 ± 11.89 | 56.78 ± 9.61* | 55.68 (± 8.21 | 60.95 ± 9.47* | 58.35 ± 13.23 | 63.69 ± 13.39* |
| HR | MA | 80.46 ± 13.68 | 89.97 ± 14.76* | 76.30 ± 15.89 | 84.30 ± 15.33* | 89.07 ± 15.28 | 98.69 ± 8.55* |
| | CG | 80.46 ± 13.68 | 87.75 ± 15.69* | 76.30 ± 15.89 | 81.45 ± 15.93* | 89.07 ± 15.28 | 98.25 ± 7.96* |
| | MR | 80.46 ± 13.68 | 88.74 ± 17.15* | 76.30 ± 15.89 | 83.25 ± 13.97* | 89.07 ± 15.28 | 96.07 ± 18.69* |
| | CP | 80.46 ± 13.68 | 85.56 ± 12.71* | 76.30 ± 15.89 | 80.89 ± 12.73* | 89.07 ± 15.28 | 92.38 ± 9.46* |

Note: CHD = Congenital Heart Disease; SBP=Systolic Blood Pressure; DBP=Diastolic Blood Pressure; HR=Heart Rate; MA=Mental Arithmetic CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = p<.05, **=p<0.01

Table 8.b.Baseline and Peak Time Based HRV Measures in Response to Mental Challenge Tasks and Cold Pressor

| | | All Participants (N=39) | | Corrected CHD (N=15) | | Uncorrected CHD (N=24) | |
|---------|----|----------------------------|------------------|-------------------------|-------------------|---------------------------|-----------------|
| | | Baseline | Peak | Baseline | Peak | Baseline | Peak |
| Mean NN | MA | 718.67 ± 154.61 | 706.24 ± 142.86* | 767.24 ± 173.05 | 754.60 ± 160.40* | 628.08 ± 53.70 | 631.85 ± 61.57* |
| | CG | 718.67 ± 154.61 | 712.12 ± 132.76 | 767.24 ± 173.05 | 762.57 ± 142.72 | 628.08 ± 53.70 | 630.61 ± 53.58 |
| | MR | 718.67 ± 154.61 | 710.41 ± 153.29 | 767.24 ± 173.05 | 760.62 ± 172.40 | 628.08 ± 53.70 | 629.31 ± 59.56 |
| | CP | 718.67 ± 154.61 | 731.45 ± 156.99 | 767.24 ± 173.05 | 798.62 ± 167.20 | 628.08 ± 53.70 | 634.44 ± 69.60 |
| SDNN | MA | 63.18 ± 21.02 | 68.03 ± 21.24* | 36.00 ± 20.25 | 67.80 ± 21.86* | 61.62 ± 23.25 | 68.38 ± 21.11* |
| | CG | 63.18 ± 21.02 | 60.00 ± 21.24 | 36.00 ± 20.25 | 60.95 ± 21.65 | 61.62 ± 23.25 | 58.46 ± 21.32 |
| | MR | 63.18 ± 21.02 | 61.50 ± 20.62 | 36.00 ± 20.25 | 65.80 ± [fill in] | 61.62 ± 23.25 | 60.77 ± 18.44 |
| | CP | 63.18 ± 21.02 | 81.00 ± 35.44* | 36.00 ± 20.25 | 83.15 ± 38.83* | 61.62 ± 23.25 | 77.89 ± 31.90* |
| SDANN | MA | 12.18 ± 10.89 | 14.94 ± 14.88 | 12.05 ± 10.79 | 14.80 ± 14.95 | 13.08 ± 11.31 | 15.15 ± 15.37 |
| | CG | 12.18 ± 10.89 | 9.88 ± 11.23 | 12.05 ± 10.79 | 8.43 ± 8.90 | 13.08 ± 11.31 | 12.23 ± 14.33 |
| | MR | 12.18 ± 10.89 | 15.44 ± 12.63 | 12.05 ± 10.79 | 17.76 ± 13.27 | 13.08 ± 11.31 | 11.69 ± 10.97 |
| | CP | 12.18 ± 10.89 | 0.68 ± 3.20* | 12.05 ± 10.79 | 1.15 ± 4.16* | 13.08 ± 11.31 | - |
| ASDNN | MA | 59.32 ± 20.49 | 64.64 ± 21.24 | 60.24 ± 19.18 | 65.10 ± 23.19 | 57.85 ± 23.18 | 63.92 ± 18.71 |

| | | | | | | | |
|-------|----|---------------|----------------|---------------|----------------|---------------|----------------|
| | CG | 59.32 ± 20.49 | 58.24 ± 20.82 | 60.24 ± 19.18 | 59.86 ± 21.06 | 57.85 ± 23.18 | 55.62 ± 21.01 |
| | MR | 59.32 ± 20.49 | 58.88 ± 20.03 | 60.24 ± 19.18 | 58.38 ± 21.01 | 57.85 ± 23.18 | 59.69 ± 19.15 |
| | CP | 59.32 ± 20.49 | 80.91 ± 35.50* | 60.24 ± 19.18 | 83.00 ± 38.93* | 57.85 ± 23.18 | 77.89 ± 31.90* |
| RMSSD | MA | 50.48 ± 24.23 | 47.15 ± 19.29 | 53.12 ± 26.36 | 50.05 ± 21.07 | 43.46 ± 21.15 | 42.69 ± 15.84 |
| | CG | 50.48 ± 24.23 | 48.35 ± 25.01 | 53.12 ± 26.36 | 54.43 ± 27.17 | 43.46 ± 21.15 | 38.54 ± 17.87 |
| | MR | 50.48 ± 24.23 | 46.82 ± 24.36 | 53.12 ± 26.36 | 50.38 ± 27.22 | 43.46 ± 21.15 | 41.08 ± 18.42 |
| | CP | 50.48 ± 24.23 | 55.73 ± 26.74 | 53.12 ± 26.36 | 56.54 ± 29.06 | 43.46 ± 21.15 | 54.56 ± 24.66 |

Note: HRV = Heart Rate Variability; CHD = Congenital Heart Disease; Mean NN=Mean of the NN interval; SDNN= Standard Deviation of the NN interval; SDANN= Standard Deviation of the Average NN interval; ASDNN= Average Standard Deviation of the NN interval; RMSSD= Square Root of the Mean Squared Differences of Successive NN intervals; MA=Mental Arithmetic CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = p<.05, **=p<0.01

Table 8.c.: Baseline and Peak Frequency
Domain-Based HRV Measures in Response to Mental Challenge Tasks and Cold
Pressor

| | | All Participants (N=39) | | Corrected CHD (N=15) | |
|-------|----|----------------------------|----------------|-------------------------|---------------|
| | | Baseline | Peak | Baseline | Peak |
| LF | MA | 2.27 ± 2.68 | 1.70 ± 2.21 | 1.80 ± 2.71 | 1.46 ± 2.38 |
| | CG | 2.27 ± 2.68 | 1.35 ± 3.11 | 1.80 ± 2.71 | 1.38 ± 4.35 |
| | MR | 2.27 ± 2.68 | 1.19 ± 3.28 | 1.80 ± 2.71 | 1.34 ± 3.79 |
| | CP | 2.27 ± 2.68 | -16.70 ± 4.48* | 1.80 ± 2.71 | -16.84 ± 4.80 |
| HF | MA | 1.96 ± 2.70 | 1.29 ± 2.26 | 1.41 ± 2.83 | 1.06 ± 2.30 |
| | CG | 1.96 ± 2.70 | 1.02 ± 3.97* | 1.41 ± 2.83 | 0.78 ± 4.92 |
| | MR | 1.96 ± 2.70 | 0.80 ± 3.94 | 1.41 ± 2.83 | 0.73 ± 4.86 |
| | CP | 1.96 ± 2.70 | -21.26 ± 4.44* | 1.41 ± 2.83 | -21.03 ± 5.56 |
| LF/HF | MA | 0.34 ± 3.62 | 1.16 ± 0.99 | -0.18 ± 4.60 | 1.29 ± 1.13 |
| Ratio | CG | 0.34 ± 3.62 | 0.31 ± 2.69 | -0.18 ± 4.60 | -0.11 ± 3.16 |
| | MR | 0.34 ± 3.62 | 2.61 ± 7.57 | -0.18 ± 4.60 | 3.70 ± 9.36 |
| | CP | 0.34 ± 3.62 | 0.79 ± 0.12* | -0.18 ± 4.60 | 0.81 ± 0.11* |

Note: HRV = Heart Rate Variability; CHD = Congenital Heart Disease; LF= power in the Low Frequency range; HF=power in the High Frequency range (HF); LF/HF Ratio= and the low frequency to high frequency ratio; MA=Mental Arithmetic CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = p<.05, **=p<0.01

Table 9.a: Correlations Between Optimism and Acute Emotional Reactivity

| | | All Participants (N=39) Correlation | Corrected CHD (N=24) Correlation | Uncorrected CHD (N=15) Correlation |
|------------|----|---|--|--|
| Liked | MA | -.09 | -.10 | -.12 |
| | CG | .01 | .05 | -.08 |
| | MR | .09 | -.01 | .17 |
| | CP | -.46* | -.62** | -.11 |
| Annoyed | MA | -.18 | -.26 | -.05 |
| | CG | -.07 | -.02 | -.13 |
| | MR | .01 | .46 | -.41 |
| | CP | .29 | .49* | -.08 |
| Interested | MA | .07 | .01 | .14 |
| | CG | .01 | -.05 | .41 |
| | MR | .23 | .14 | .30 |
| | CP | -.11 | -.10 | -.11 |

MA=Mental Arithmetic CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = $p < .05$, **= $p < 0.01$

Table 9.b.: Correlations Between Optimism and Hemodynamic Reactivity

| | | All Participants (N=39) Correlation | Corrected CHD (N=24) Correlation | Uncorrected CHD (N=15) Correlation |
|-----|----|--|---|---|
| SBP | BL | .03 | .28 | -.15 |
| | MA | -.17 | -.28 | -.03 |
| | CG | .12 | -.01 | .36 |
| | MR | -.18 | -.27 | -.09 |
| | CP | .19 | .01 | .50 |
| DBP | BL | -.001 | -.55 | .08 |
| | MA | .07 | .16 | -.09 |
| | CG | .12 | .13 | .08 |
| | MR | .15 | .24 | -.10 |
| | CP | -.02 | -.07 | .05 |
| HR | BL | -.11 | .04 | -.22 |
| | MA | .06 | .14 | -.17 |
| | CG | -.09 | .09 | -.42 |
| | MR | .07 | .32 | -.39 |
| | CP | .10 | .23 | -.32 |

Note: CHD = Congenital Heart Disease; SBP=Systolic Blood Pressure;
 DBP=Diastolic Blood Pressure; HR=Heart Rate; Reactivity=Change Score;
 BL=Baseline; MA=Mental Arithmetic; CG = Computer Game; MR = Mirror Trace;
 CP = Cold Pack; * = $p < .05$, **= $p < 0.01$

Table 9.c.: Correlations Between Optimism and Time Based Heart HRV Reactivity

| | | All Participants (N=39) Correlation | Corrected CHD (N=24) Correlation | Uncorrected CHD (N=15) Correlation |
|---------|----|---|--|--|
| Mean NN | BL | -0.09 | -0.28 | 0.42 |
| | MA | -0.22 | -0.20 | -0.59* |
| | CG | -0.06 | -0.04 | -0.24 |
| | MR | 0.07 | 0.19 | -0.38 |
| | CP | -0.09 | 0.03 | -0.44 |
| SDNN | BL | 0.05 | -0.04 | 0.17 |
| | MA | 0.14 | 0.31 | -0.27 |
| | CG | -0.001 | -0.18 | 0.28 |
| | MR | 0.32 | 0.27 | 0.43 |
| | CP | -0.08 | -0.10 | -0.21 |
| SDANN | BL | 0.12 | 0.15 | 0.09 |
| | MA | 0.11 | 0.24 | -0.18 |
| | CG | 0.06 | 0.22 | -0.17 |
| | MR | -0.01 | -0.07 | 0.20 |
| | CP | -0.02 | -0.06 | -.01 |
| ASDNN | BL | 0.06 | -0.06 | 0.22 |
| | MA | 0.25 | 0.31 | 0.08 |
| | CG | 0.14 | 0.21 | 0.03 |
| | MR | 0.30 | 0.22 | 0.41 |
| | CP | -0.04 | 0.07 | -0.13 |
| RMSSD | BL | -0.13 | -0.24 | 0.04 |

| | | | |
|----|------|--------------|-------|
| MA | 0.02 | 0.09 | -0.21 |
| CG | 0.10 | 0.21 | -0.09 |
| MR | 0.36 | 0.48* | 0.03 |
| CP | 0.13 | 0.12 | -0.19 |

Note: HRV = Heart Rate Variability; CHD = Congenital Heart Disease; Mean NN=Mean of the NN interval; SDNN= Standard Deviation of the NN interval; SDANN= Standard Deviation of the Average NN interval; ASDNN= Average Standard Deviation of the NN interval; RMSSD= Square Root of the Mean Squared Differences of Successive NN intervals; Reactivity=Change Score; BL=Baseline; MA=Mental Arithmetic; CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = $p < .05$, **= $p < 0.01$

Table 9.d. Correlations Between Optimism and Frequency Based HRV Reactivity

| | | All Participants (N=39) Correlation | Corrected CHD (N=24) Correlation | Uncorrected CHD (N=15) Correlation |
|----------------|----|---|--|--|
| LF | BL | -0.07 | -0.23 | 0.31 |
| | MA | 0.05 | -0.02 | 0.25 |
| | CG | -0.12 | -0.27 | 0.25 |
| | MR | -0.29 | -0.32 | -0.16 |
| | CP | -0.09 | 0.11 | -0.53 |
| HF | BL | -0.08 | -0.16 | 0.18 |
| | MA | 0.04 | 0.07 | 0.02 |
| | CG | -0.14 | -0.23 | 0.14 |
| | MR | -0.31 | -0.35 | -0.18 |
| | CP | -0.06 | 0.02 | -0.13 |
| LF/HF Ratio | BL | 0.31 | 0.40 | 0.07 |
| | MA | 0.28 | 0.41 | -0.25 |
| | CG | 0.12 | 0.14 | 0.24 |
| | MR | 0.20 | 0.28 | 0.21 |
| | CP | 0.03 | -0.01 | 0.11 |

Note: HRV = Heart Rate Variability; CHD = Congenital Heart Disease; LF= power in the Low Frequency range; HF=power in the High Frequency range (HF); LF/HF Ratio= and the low frequency to high frequency ratio; Reactivity=Change Score; BL=Baseline; MA=Mental Arithmetic; CG = Computer Game; MR = Mirror Trace; CP = Cold Pack; * = $p < .05$, **= $p < 0.01$

Table 10.a. Psychological Predictors of SBP Reactivity during Mirror Trace

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|-------|------|--------------------------|-------------|------------------------|
| Group status | <0.01 | <0.01 | 0.96 | <0.01 | <0.01 | 0.96 |
| Family Environment | 0.26 | 3.26 | 0.04 | 0.12 | 4.23 | 0.05 |
| Optimism | 0.28 | 2.51 | 0.06 | 0.02 | .69 | 0.41 |
| Group x Optimism Interaction | 0.31 | 2.36 | 0.07 | 0.04 | 1.33 | 0.26 |

Note: SBP=Systolic Blood Pressure; * = p<.05, **=p<0.01

Table 10.b. Psychological Predictors of DBP Reactivity during the Mirror Trace

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Group status | 0.08 | 2.57 | 0.12 | 0.08 | 2.57 | 0.12 |
| Family Environment | 0.32 | 4.41 | 0.01 | 0.18 | 7.23 | 0.01 |
| Optimism | 0.35 | 3.67 | 0.02 | 0.03 | 1.31 | 0.26 |
| Group x Optimism Interaction | 0.38 | 3.14 | 0.02 | 0.02 | 1.02 | 0.32 |

Note: DBP=Diastolic Blood Pressure; * = p<.05, **=p<0.01

Table 10.c. Psychological Predictors of HR Reactivity during the Mirror Trace

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|-------|------|--------------------------|-------------|------------------------|
| Group status | <0.01 | <0.01 | 0.98 | <0.01 | <0.01 | 0.98 |
| Family Environment | 0.11 | 1.19 | 0.33 | 0.02 | 0.52 | 0.48 |
| Optimism | 0.12 | 0.88 | 0.49 | <0.01 | 0.07 | 0.79 |
| Group x Optimism Interaction | 0.20 | 1.30 | 0.30 | 0.08 | 2.735 | 0.11 |

Note: HR=Heart rate; * = p<.05, **=p<0.01

Table 10.d. Psychological Predictors of HR Reactivity during the Computer Game

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Group status | <0.01 | 0.24 | 0.63 | <0.01 | 0.24 | 0.63 |
| Family Environment | 0.09 | 0.80 | 0.51 | <0.01 | 0.22 | 0.65 |
| Optimism | 0.09 | 0.52 | 0.68 | <0.01 | 0.04 | 0.85 |
| Group x Optimism Interaction | 0.11 | 0.56 | 0.73 | 0.02 | 0.51 | 0.48 |

Note: HR= Heart Rate; * = $p < .05$, **= $p < 0.01$

Table 10.e. Psychological Predictors of HR Reactivity during Cold Pressor

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|-------|--------------------------|-------------|------------------------|
| Group status | 0.02 | 0.49 | 0.49 | 0.02 | 0.49 | 0.49 |
| Family Environment | 0.39 | 5.42 | <0.01 | <0.01 | 0.05 | 0.82 |
| Optimism | 0.40 | 4.04 | 0.01 | <0.01 | 0.33 | 0.57 |
| Group x Optimism Interaction | 0.45 | 3.77 | 0.01 | 0.05 | 2.00 | 0.17 |

Note: HR=Heart rate; * = p<.05, **=p<0.01

Table 11.a.: Psychological Predictors of the mean NN interval during Mental Arithmetic

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.01 | 0.31 | 0.58 | 0.01 | 0.31 | 0.58 |
| Group status | 0.23 | 2.82 | 0.06 | 0.09 | 3.24 | 0.08 |
| Optimism | 0.24 | 3.40 | 0.02 | 0.10 | 4.19 | 0.05 |
| Group x Optimism Interaction | 0.34 | 2.72 | 0.04 | 0.01 | 0.32 | 0.57 |

Note: Mean NN=Mean of the NN interval; HRV=Heart Rate Variability; * = p<.05, **=p<0.01

Table 11.b. Psychological Predictors of the mean NN interval during the Mirror Trace Task

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.01 | 0.27 | 0.61 | 0.01 | 0.27 | 0.61 |
| Group status | 0.02 | 0.22 | 0.88 | <0.01 | 0.01 | 0.91 |
| Optimism | 0.04 | 0.29 | 0.59 | 0.02 | 0.50 | 0.49 |
| Group x Optimism Interaction | 0.05 | 0.29 | 0.91 | 0.01 | 0.34 | 0.57 |

Note: Mean NN=Mean of the NN interval; HRV=Heart Rate Variability; * = p<.05, **=p<0.01

Table 11.c. Psychological Predictors of RMSSD HRV during the Mirror Trace Task

| Predictors | R ² | F | p | R ² Change | F Change | F Change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.13 | 4.29 | 0.05 | 0.12 | 4.29 | 0.05* |
| Group Status | 0.13 | 2.10 | 0.14 | <0.01 | 0.04 | 0.84 |
| Optimism | 0.20 | 1.76 | 0.18 | 0.04 | 1.40 | 0.25 |
| Group x Optimism Interaction | 0.21 | 1.67 | 0.18 | <0.01 | 0.17 | 0.69 |

Note: RMSSD= Root Mean Square Successive Differences; HRV=Heart Rate Variability; * = p<.05, **=p<0.01

Table 11.d. Psychological Predictors of Low Frequency HRV during Cold Pressor

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.05 | 0.94 | 0.35 | 0.06 | 0.94 | 0.35 |
| Group status | 0.09 | 0.45 | 0.72 | 0.03 | 0.52 | 0.48 |
| Optimism | 0.12 | 0.40 | 0.80 | 0.03 | 0.41 | 0.53 |
| Group x Optimism Interaction | 0.12 | 0.34 | 0.88 | <0.01 | 0.06 | 0.81 |

Note: LF= power in the Low Frequency range; HRV=Heart Rate Variability; * = p<.05, **=p<0.01

Table 11.e. Psychological Predictors of High Frequency HRV during Mirror Trace Task

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.07 | 2.19 | 0.16 | 0.07 | 2.13 | 0.16 |
| Group status | 0.12 | 2.40 | 0.09 | 0.02 | 0.65 | 0.43 |
| Optimism | 0.15 | 2.65 | 0.06 | 0.06 | 1.94 | 0.18 |
| Group x Optimism Interaction | 0.18 | 2.05 | 0.10 | <0.01 | <0.01 | 0.96 |

Note: HF=power in the High Frequency range; HRV=Heart Rate Variability; * = p<.05, **=p<0.01

Table 12: The Predictive Value of Optimism, Family Environment and Anxiety for HF HRV Reactivity during the Mirror Trace Task

| Predictors | R ² | F | p | R ² Change | F Change | F change p value |
|---------------------------------|----------------|------|------|--------------------------|-------------|------------------------|
| Family Environment | 0.06 | 1.94 | 0.17 | 0.06 | 1.94 | 0.17 |
| Anxiety-P | 0.13 | 2.15 | 0.14 | 0.07 | 2.28 | 0.14 |
| Group status | 0.25 | 2.18 | 0.10 | 0.01 | 0.46 | 0.51 |
| Optimism | 0.36 | 2.81 | 0.04 | 0.11 | 4.24 | 0.05 |
| Group x Optimism Interaction | 0.36 | 2.25 | 0.07 | <0.01 | 0.02 | 0.90 |

Note: HF=High Frequency; HRV=Heart Rate Variability; Anxiety-P =Child's Anxiety Level,

Parent Rating; * = $p < .05$, **= $p < 0.01$

Figures

Figure 1: Theoretical Model Linking Optimism to Cardiovascular Outcome

(H1, H2 = study hypotheses 1 and 2 respectively)

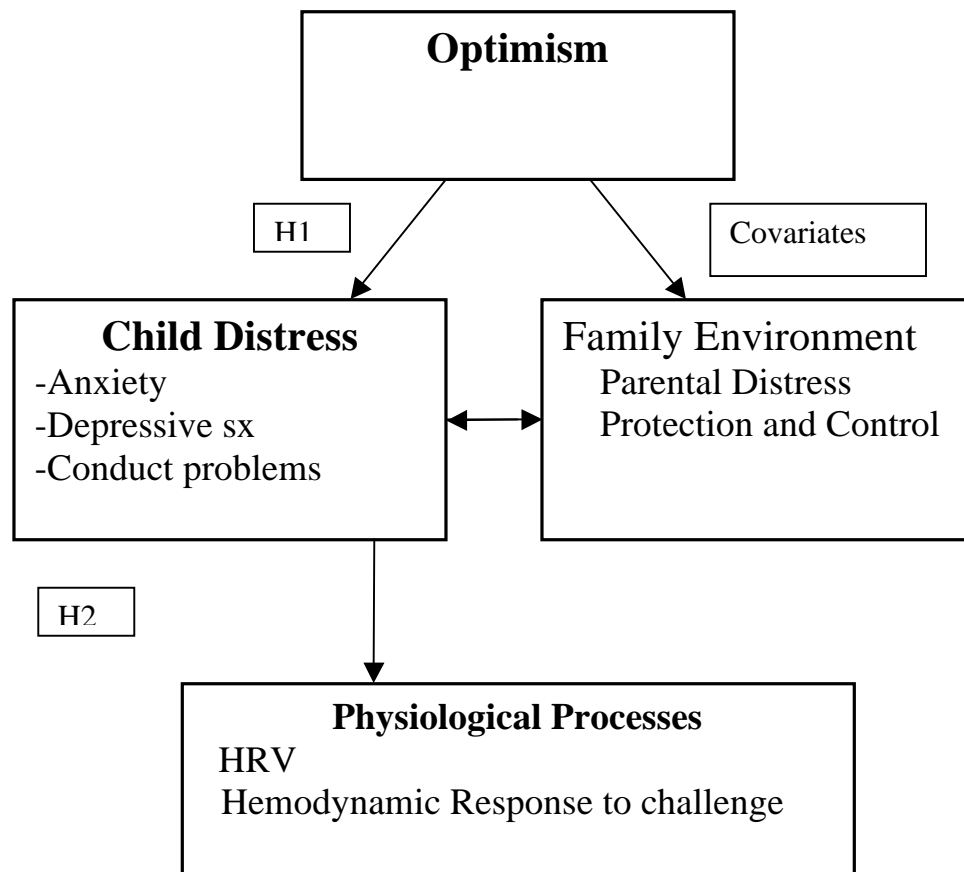
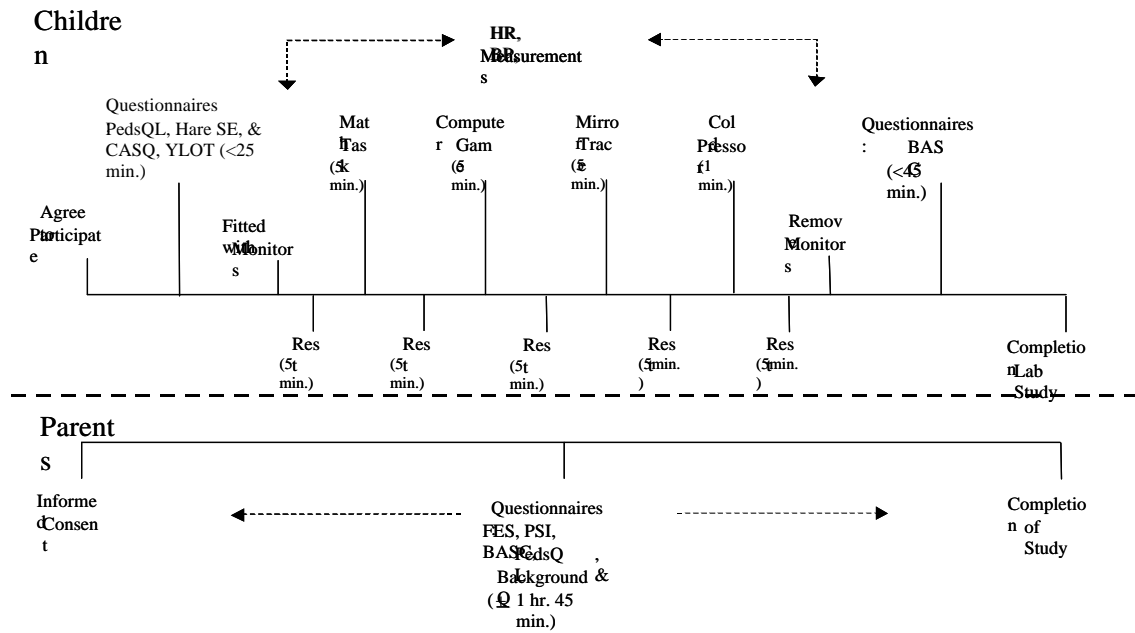


Figure 2: Outline of Study Procedures



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Appendix A

CASQ

1. YOU GET **AN "A"** ON A TEST.
A. I AM SMART.
B. I AM GOOD I N THE SUBJECT THAT THE TEST WAS IN.
2. YOU PLAY A GAME WITH SOME FRIENDS AND YOU WIN.
A. THE PEOPLE THAT I PLAYED WITH DID NOT PLAY THE GAME WELL.
B. I PLAY THAT GAME WELL.
3. YOU SPEND A NIGHT AT A FRIEND'S HOUSE AND YOU HAVE A GOOD TIME .
A. MY FRIEND WAS IN A FRIENDLY MOOD THAT NIGHT.
B. EVERYONE IN MY FRIEND'S FAMILY **WAS IN** A FRIENDLY MOOD THAT NIGHT.
4. YOU GO ON A VACATION WITH A GROUP OF PEOPLE AND YOU HAVE FUN.
A. I WAS I N A GOOD MOOD.
B. THE PEOPLE I WAS WITH WERE I N GOOD MOODS.
5. ALL OF YOUR FRIEND'S CATCH A COLD EXCEPT YOU.
A. I HAVE BEEN HEALTHY LATELY.
B. I AM A HEALTHY PERSON.
6. YOUR PET GETS RUN OVER BY A CAR.
A. I DON'T TAKE GOOD CARE OF MY PETS.
B. DRIVERS ARE NOT CAUTIOUS ENOUGH.
7. SOME KIDS THAT YOU KNOW SAY THAT THEY DO NOT LIKE YOU.
A. ONCE I N A WHILE PEOPLE ARE **MEAN** TO ME.
B. ONCE I N A WHILE I AM MEAN TO OTHER PEOPLE.
8. YOU GET VERY GOOD GRADES.
A. SCHOOL WORK IS SIMPLE.
B. I AM A **HARD** WORKER.

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9. YOU MEET A FRIEND AND YOUR FRIEND TELLS YOU THAT YOU LOOK NICE.
A. MY FRIEND FELT LIKE PRAISING THE WAY PEOPLE LOOKED THAT DAY.
B. USUALLY MY FRIEND PRAISES THE WAY PEOPLE LOOK.
10. A GOOD FRIEND TELLS YOU THAT HE HATES YOU.
A. MY FRIEND WAS IN BAD MOOD THAT DAY.
B. I WASN'T NICE TO MY FRIEND THAT DAY.
11. YOU TELL A JOKE AND NO ONE LAUGHS.
A. I DO NOT TELL JOKES WELL.
B. THE JOKE IS SO WELL KNOWN THAT IT IS NO LONGER FUNNY.
12. YOUR TEACHER GIVES A LESSON AND YOU DO NOT UNDERSTAND IT.
A. I DIDN'T PAY ATTENTION TO ANYTHING THAT DAY.
B. I DIDN'T PAY ATTENTION WHEN MY TEACHER WAS TALKING.
13. YOU FAIL A TEST.
A. MY TEACHER MAKES HARD TESTS.
B. THE PAST FEW WEEKS MY TEACHER HAS MADE HARD TESTS.
14. YOU GAIN A LOT OF WEIGHT AND START TO LOOK FAT.
A. THE FOOD THAT I HAVE TO EAT IS FATTENING.
B. I LIKE FATTENING FOODS.
15. A PERSON STEALS MONEY FROM YOU.
A. THAT PERSON IS DISHONEST.
B. PEOPLE ARE DISHONEST.
16. YOUR PARENTS PRAISE SOMETHING THAT YOU MAKE.
A. I AM GOOD AT MAKING SOME THINGS.
B. MY PARENTS LIKE SOME THINGS THAT I MAKE.
17. YOU PLAY A GAME AND YOU WIN MONEY.
A. I AM A LUCKY PERSON.
B. I AM A LUCKY PERSON WHEN I PLAY GAMES.
18. YOU ALMOST DROWN WHEN SWIMMING IN A RIVER.
A. I AM NOT A VERY CAUTIOUS PERSON,
B. SOMEDAYS I AM NOT A CAUTIOUS PERSON.

19. YOU ARE INVITED TO A LOT OF PARTIES.
A. A LOT OF PEOPLE HAVE BEEN ACTING FRIENDLY TOWARD ME LATELY.
B. I HAVE BEEN ACTING FRIENDLY TOWARD A LOT OF PEOPLE LATELY.
20. A GROWNUP YELLS AT YOU.
A. THAT PERSON YELLED AT THE FIRST PERSON HE SAW,
B. THAT PERSON YELLED AT A LOT OF PEOPLE HE SAW THAT DAY.
21. YOU DO A PROJECT WITH A GROUP OF KIDS AND IT TURNS OUT BADLY,
A. I DON'T WORK WELL WITH THE PEOPLE I N THE GROUP.
B. I NEVER WORK WELL WITH A GROUP.
- 22 . YOU MAKE A NEW FRIEND,
A. I AM A NICE PERSON.
B. THE PEOPLE THAT I MEET ARE NICE.
23. YOU HAVE BEEN GETTING ALONG WELL WITH YOUR FAMILY.
A. I AM EASY TO GET ALONG WITH WHEN I AM WITH MY FAMILY.
B. ONCE I N A WHILE I AM EASY TO GET ALONG WITH WHEN I AM WITH MY FAMILY.
- 24 . YOU TRY TO SELL CANDY, BUT NO ONE WILL BUY ANY.
A. LATELY A LOT OF CHILDREN ARE SELLING THINGS, SO PEOPLE DON'T WANT TO BUY ANYTHING ELSE FROM CHILDREN.
B. PEOPLE DON'T LIKE TO BUY THINGS FROM CHILDREN.
- 25 . YOU PLAY A GAME AND YOU WIN.
A. SOMETIMES I TRY AS HARD AS I CAN AT GAMES.
B. SOMETIMES I TRY AS HARD AS I CAN.
- 26 . YOU GET A BAD GRADE I N SCHOOL.
A. I AM STUPID.
B. TEACHERS ARE UNFAIR GRADERS.
27. YOU WALK INTO A DOOR AND YOU GET A BLOODY NOSE.
A. I WASN'T LOOKING WHERE I WAS GOING,
B. I HAVE BEEN CARELESS LATELY.
28. YOU MISS THE BALL AND YOUR TEAM LOSES THE GAME.
A. I DIDN'T TRY HARD WHILE-PLAYING BALL THAT DAY.
B. I USUALLY DO NOT TRY HARD WHEN I AM PLAYING BALL.

29. YOU TWIST YOUR ANKLE IN GYM CLASS.
A. THE PAST FEW WEEKS THE SPORTS WE PLAYED IN GYM CLASS HAVE BEEN DANGEROUS.
B. **THE PAST FEW WEEKS I HAVE BEEN CLUMSY IN GYM CLASS.**
30. YOUR PARENTS TAKE YOU TO THE BEACH AND YOU HAVE A GOOD TIME.
A. EVERYTHING AT THE BEACH WAS NICE THAT DAY.
B. THE WEATHER AT THE BEACH WAS NICE THAT DAY.
31. YOU TAKE A TRAIN WHICH ARRIVES SO LATE THAT YOU MISS A MOVIE.
A. THE PAST FEW DAYS THERE HAVE BEEN PROBLEMS WITH THE TRAIN BEING ON TIME.
B. THE TRAINS ARE ALMOST NEVER ON TIME.
32. YOUR MOTHER MAKES YOU YOUR FAVORITE DINNER.
A. THERE ARE A FEW THINGS THAT MY MOTHER WILL DO TO PLEASE ME.
B. MY MOTHER LIKES TO PLEASE ME.
33. A TEAM THAT YOU ARE ON LOSES A GAME.
A. THE TEAM MEMBERS DON'T PLAY WELL TOGETHER.
B. THAT DAY THE TEAM MEMBERS DIDN'T PLAY WELL TOGETHER.
34. YOU FINISH YOUR HOMEWORK QUICKLY.
A. LATELY I HAVE BEEN DOING EVERYTHING QUICKLY.
B. LATELY I HAVE BEEN DOING SCHOOLWORK QUICKLY.
35. YOUR TEACHER ASKS YOU A QUESTION AND YOU GIVE THE WRONG ANSWER.
A. I GET NERVOUS WHEN I HAVE TO ANSWER QUESTIONS.
B. THAT DAY I GOT NERVOUS WHEN I HAD TO ANSWER QUESTIONS.
36. YOU GET ON THE WRONG BUS AND YOU GET LOST.
A. THAT DAY I WASN'T PAYING ATTENTION TO WHAT WAS GOING ON.
B. I USUALLY DON'T PAY ATTENTION TO WHAT'S GOING ON.
37. YOU GO TO **AN** AMUSEMENT **PARK** AND YOU HAVE A GOOD TIME.
A. I USUALLY ENJOY MYSELF AT AMUSEMENT PARKS.
B. I USUALLY ENJOY MYSELF.
38. AN OLDER KID SLAPS YOU IN THE FACE,
A. I TEASED HIS YOUNGER BROTHER.
B. HIS YOUNGER BROTHER TOLD HIM I HAD TEASED HIM.

39. YOU GET THE TOYS YOU WANT ON YOUR BIRTHDAY.
A. PEOPLE ALWAYS GUESS WHAT TOYS TO BUY ME FOR MY BIRTHDAY.
B. THIS BIRTHDAY PEOPLE GUESSED RYGT AS TO WHAT TOYS I WANTED.
40. YOU **TAKE** A VACATION IN THE COUNTRY **AND** YOU HAVE A WONDERFUL TIME.
A. THE COUNTRY IS A BEAUTIFUL PLACE TO BE.
B. THE TIME OF THE YEAR THAT WE WENT WAS BEAUTIFUL.
41. YOUR NEIGHBORS ASK YOU OVER FOR DINNER.
A. SOMETIMES PEOPLE ARE IN KIND MOODS.
B. PEOPLE ARE KIND.
42. YOU HAVE A SUBSTITUTE TEACHER AND SHE LIKES YOU.
A. I WAS **WELL** BEHAVED DURING CLASS THAT DAY.
B. I AM ALMOST ALWAYS WELL BEHAVED DURING CLASS.
43. YOU **MAKE** YOUR FRIENDS HAPPY.
A. I **AM** A FUN PERSON TO BE WITH.
B. SOMETIMES I AM A FUN PERSON TO BE WITH.
44. YOU GET **A-FREE** ICE-CREAM CONE.
A. I WAS FRIENDLY TO THE ICE-CREAM MAN THAT DAY.
B. THE ICE-CREAM MAN WAS FEELING FRIENDLY THAT DAY.
45. AT YOUR FRIEND'S PARTY THE MAGICIAN ASKS YOU TO HELP HIM OUT.
A. IT WAS JUST LUCK THAT I GOT PICKED.
B. I LOOKED REALLY INTERESTED IN WHAT WAS GOING ON.
46. YOU TRY TO CONVINCE A KID TO GO TO THE MOVIES WITH YOU, BUT HE WON'T GO.
A. THAT DAY HE DID NOT FEEL LIKE DOING ANYTHING.
B. THAT DAY HE DID NOT FEEL LIKE GOING TO THE MOVIES.
47. YOUR PARENTS GET A DIVORCE.
A. IT IS HARD FOR PEOPLE TO GET ALONG WELL WHEN THEY ARE MARRIED,
B. IT IS HARD FOR MY PARENTS TO GET ALONG WELL WHEN THEY ARE MARRIED.
48. YOU HAVE BEEN TRYING TO GET INTO A CLUB AND YOU DON'T GET IN.
A. I **DON'T** GET ALONG WELL WITH OTHER PEOPLE.
B. I CAN'T GET ALONG WELL WITH THE PEOPLE IN THE CLUB.

Selected Questions from the YLOT

First, the experimenter presents six questions for the child. The questions are “abstract” optimism-pessimism questions.

After these six questions the experimenter presents 20 picture cards to the child. For every card there is a specific question. We present the cards displaying simple pictures relating to the specific question (the purpose of the picture is to keep the child focused on the specific question). For example we display a picture of a plate when presenting the first question and a picture of a cat when presenting the sixth question. Cards and questions are presented in the same order for each child.

Abstract optimism-pessimism questions

1. If you do not know what is ahead do you expect it to be something nice? (Opt)
2. Each morning do you believe that nothing is going to work during the day? (Pes)
3. When things are bad in the morning do you expect them to get better during the day? (Opt)
4. When things are good, do you expect something to go wrong? (Pes)
5. Do you expect more pleasant than unpleasant things happen to you during the day? (Opt)
6. When you anticipate something nice to happen, are you usually prepared for disappointment? (Pes)

Optimism-Pessimism Test Instrument – Revised

1. Imagine that you are trying to eat all of your vegetables. If you finish them, your aunt has promised you a dessert that you have never tasted. Do you think you will like the dessert or will it taste bad?
2. Imagine that you and a friend are walking home from school. You suddenly see something shiny near a stream, but you're not sure what it is. Do you think you will find a shiny new quarter or just part of an old tin can?
3. Imagine that you have been learning to play the trumpet. Tomorrow you are playing in a contest. Do you think that you are going to win a prize tomorrow or do you think you will lose?
4. Imagine that the baseball / softball season is just beginning. This year you will be playing in the older league for the first time. Do you think you will play badly or will you play well?
5. Imagine that you are riding on your bicycle when you suddenly see a \$5.00 bill in front of you. Will the money blow away before you can get to it or will you catch it?

6. Imagine that you have been looking for your cat all day. You're afraid that if you don't find her today, she will be stuck without food. Do you think you will find your cat or will your cat stay hidden?
7. Imagine that your parents just left you at nursery school for the first time. You are so sad that you start to cry. The teacher picks you up and tries to make you feel better. You are afraid because your brother said nursery school was horrible. Do you think you are going to be sad at school or will you like it there?
8. Imagine that you and your friend spent all day collecting bird's eggs. You found so many eggs that you had to leave some where you found them. Now you are worried that someone may have taken them. Do you think your eggs are stolen or are you looking in the wrong spot?
9. Imagine that your friend is moving out of the house next door. You are hoping that a new boy or girl your age will move in that you can play with-otherwise you will be all alone on the block. Do you think you will be alone or will you find a new friend?
10. Imagine that you went to the store for your mother. On the way home, you can't find the money you had left over. You are looking for the change in the street. Do you think you lost the change or do you think you will find it?
11. Imagine that you are trying to carry home a heavy paper bag. You're trying to carry it without the bag breaking. Do you think you'll get the bag home okay or do you think the bag will break?
12. Imagine that you have just moved into a new home, and you are taking a walk around the block. Then you meet three other children from the neighborhood. Two of them don't look very friendly. Do you think they'll be mean to you or do you think they will want to make friends?
13. Imagine that you just saw a beehive behind a tree. You are afraid that one of the bees will sting you. Do you think that you will be able to get home without a bee sting or will one of the bees get you?
14. Imagine that you like to play ball with your friends. But every time you go to play you have to sit and watch because there are too many children who want to play. Do you think you will have to watch again today or do you think that you'll get a chance to play?
15. Imagine that somebody just gave you something to eat that you have never had before. Do you think you are going to like it or do you think you are going to hate it?

16. Imagine that you found a little puppy in the park. The puppy doesn't have a home, and your parents won't let you keep the puppy. Do you think you will be able to find a new home for the puppy or will you have to leave the puppy in the park?
17. Imagine that your mother took you and a friend to a sleep-over camp for the first time. None of the other children are there yet. You wonder if you are in the wrong place! Do you think you are in the wrong place and the other children won't come or do you think the other children will come soon?
18. Imagine that you are waiting for your friend to give you a turn with the jump rope. Recess is going to be over soon, and you are afraid that you won't get to jump rope before the bell rings. Will the bell ring before you get a turn or will you have a change to jump rope?
19. Imagine that you and your family are at the beach for the day. When your father left you and you and your older sisters, he gave your sisters some money to buy lunch. Now you can't find the money near the towel where you left it. Do you think you will find the money in the sand or do you think you'll have to stay all day without food?
20. Imagine that you and your friends are all drawing pictures for the local art contest tomorrow. First prize is big box of paints and crayons, which you have wanted for a long time. Do you think you will win the prize or will someone else win it?

Appendix B

Behavioral Assessment System for Children Self-Report

| | | | | | |
|------------------|--------|------|---|-----|------|
| Your name _____ | | | School _____ | | |
| First | Middle | Last | | | |
| Date _____ | | | Age _____ | | |
| Month | Day | Year | Month | Day | Year |
| Birth date _____ | | | Sex: <input type="checkbox"/> Girl <input type="checkbox"/> Boy <input type="checkbox"/> Other da | | |

| | | |
|--|--|---|
| <p>1. I think I am very creative. T F</p> <p>2. School has too many rules. T F</p> <p>3. People expect too much from me. T F</p> <p>4. I need help to get along with others. T F</p> <p>5. I often have nightmares. T F</p> <p>6. My parents are often proud of me. T F</p> <p>7. I hear things that others cannot hear. T F</p> <p>8. Life is getting worse and worse. T F</p> <p>9. My teacher gets mad at me for nothing. T F</p> <p>10. I quit easily. T F</p> <p>11. I wish I were someone else. T F</p> <p>12. Other people always find things wrong with me. T F</p> <p>13. I am dependable. T F</p> <p>14. People get mad at me, even when I don't do anything wrong. T F</p> <p>15. I hate school. T F</p> <p>16. I worry a lot of the time. T F</p> <p>17. I am always nice to teachers. T F</p> <p>18. Sometimes voices tell me to do bad things. T F</p> <p>19. Nothing ever goes right for me. T F</p> <p>20. I am always disappointed with my grades. T F</p> <p>21. Other children are happier than I am. T F</p> <p>22. My parents have too much control over my life. T F</p> <p>23. I have never been in a car. T F</p> <p>24. I wish there were no report cards. T F</p> <p>25. I see weird things. T F</p> <p>26. Sometimes my teacher makes me feel stupid. T F</p> | <p>27. When I am wrong I can change things to be right again. T F</p> <p>28. I don't care about school. T F</p> <p>29. I can't stop myself from making mistakes. T F</p> <p>30. My friends are usually kind to me. T F</p> <p>31. I am afraid I might do something bad. T F</p> <p>32. My parents think I am dumb. T F</p> <p>33. I go from happy to mad very fast. T F</p> <p>34. No one understands me. T F</p> <p>35. When I get a bad grade, it's usually because the teacher doesn't like me. T F</p> <p>36. When I take tests, I can't think. T F</p> <p>37. I like who I am. T F</p> <p>38. I wish I were invited to more parties. T F</p> <p>39. I can usually solve a difficult problem by myself. T F</p> <p>40. My parents control my life. T F</p> <p>41. I don't like thinking about school. T F</p> <p>42. I am bothered by thoughts about death. T F</p> <p>43. My teacher cares about me. T F</p> <p>44. I cannot stop myself from doing bad things. T F</p> <p>45. Adults have a better life than I do. T F</p> <p>46. I cover up my work when the teacher walks by. T F</p> <p>47. People say bad things to me. T F</p> <p>48. What I want never seems to matter. T F</p> <p>49. My feelings get hurt easily. T F</p> <p>50. I prefer to be alone most of the time. T F</p> <p>51. I hear voices in my head. T F</p> <p>52. Teachers mostly look for the bad things that you do. T F</p> | <p>53. If I have a problem, I can usually work it out.</p> <p>54. School is boring.</p> <p>55. I get blamed for things I can't help.</p> <p>56. My classmates don't like me.</p> <p>57. I often worry about something bad happening to me.</p> <p>58. My mother and father hate me if I ask them to.</p> <p>59. I cannot control my thoughts.</p> <p>60. I am always in trouble with someone.</p> <p>61. Most teachers are unfair.</p> <p>62. I want to do better, but I can't.</p> <p>63. I like the way I look.</p> <p>64. People act as if they don't hear me.</p> <p>65. My teacher doesn't help me very much.</p> <p>66. My parents blame me for too many of their problems.</p> <p>67. Superman is a real person.</p> <p>68. I worry about what other people think about me.</p> <p>69. My parents trust me.</p> <p>70. Sometimes, when alone, I hear my name.</p> <p>71. I am good at only one or two things.</p> <p>72. It is hard for me to keep my mind on schoolwork.</p> <p>73. I feel out of place around other kids.</p> <p>74. Bad things just happen.</p> <p>75. Little things bother me a lot.</p> <p>76. Nobody ever listens to me.</p> <p>77. Other kids hate to be with me.</p> |
|--|--|---|

| | | |
|--|---|---|
| 78. I am good at being myself. T F | 103. I am a dependable friend. T F | 128. I am good at making decisions. T F |
| 79. My school feels good to me. T F | 104. I can hardly wait to quit school. T F | 129. I can't wait for school to be over. T F |
| 80. My parents often nag me about doing chores at home. T F | 105. It doesn't matter if I say I am sorry, people are still mad at me. T F | 130. My parents expect too much from me. T F |
| 81. My classmates make fun of me. T F | 106. People think I am fun to be with. T F | 131. Other children don't like to be with me. T F |
| 82. I worry when I go to bed at night. T F | 107. I am bothered by not getting enough sleep. T F | 132. I feel guilty about things. T F |
| 83. I like to show my report card to my mother and father. T F | 108. I like to be close to my parents. T F | 133. My parents don't think much of me. T F |
| 84. I itch on the inside. T F | 109. I have many accidents. T F | 134. I see things that others cannot see. T F |
| 85. I think I am dumb next to my friends. T F | 110. I used to be happier. T F | 135. I prefer not to be noticed. T F |
| 86. My teacher understands me. T F | 111. My teacher is always telling me what to do. T F | 136. My teacher is often proud of me. T F |
| 87. I usually fail. T F | 112. Tests are not fair to most people. T F | 137. I give up easily. T F |
| 88. I wish I were different. T F | 113. I have nice hair. T F | 138. I am nice looking. T F |
| 89. Sometimes I feel lonely, even when there are people with me. T F | 114. I am lonely. T F | 139. I feel someone will tell me I do things the wrong way. T F |
| 90. I am good at schoolwork. T F | 115. I like to answer questions in class. T F | 140. I always do homework on time. T F |
| 91. I can't seem to control what happens to me. T F | 116. Things go wrong for me, even when I try hard. T F | 141. My parents are always telling me what to do. T F |
| 92. I drink 50 glasses of milk every day. T F | 117. Nobody likes me. T F | 142. Other people make fun of me. T F |
| 93. I am nervous. T F | 118. I get nervous when things do not go the right way for me. T F | 143. I am afraid of a lot of things. T F |
| 94. My parents like to help with my homework. T F | 119. I have no teeth. T F | 144. I have never been to sleep. T F |
| 95. My skin feels funny sometimes. T F | 120. Sometimes I want to hurt myself. T F | 145. Sometimes I can't stop what I am doing. T F |
| 96. I am always in trouble at home. T F | 121. I just don't care anymore. T F | 146. Nothing about me is right. T F |
| 97. Most of the time, you have to cheat to win. T F | 122. I never have time to do all my schoolwork. T F | 147. I often get sick before tests. T F |
| 98. I want to be more independent, but it scares me. T F | 123. I am bothered by rumors about me or my friends. T F | 148. I am bothered by teasing from others. T F |
| 99. I am blamed for a lot of things I don't do. T F | 124. My mother and father like my friends. T F | 149. My parents listen to what I say. T F |
| 100. I worry about disappointing my parents. T F | 125. I worry about what is going to happen. T F | 150. I worry over tests at school. T F |
| 101. I always have bad luck. T F | 126. I have too many problems. T F | 151. Nothing goes my way. T F |
| 102. Others have respect for me. T F | 127. I am good at showing others how to do things. T F | 152. I smile and laugh a lot. T F |

Please be sure you have marked all items.

Behavioral Assessment System for Children Parent Report

| | | | | | |
|--|--|--|--|--|--|
| Child's name _____ | | | Your name _____ | | |
| <div style="display: flex; justify-content: space-between; font-size: small;"> First Middle Last </div> | | | <div style="display: flex; justify-content: space-between; font-size: small;"> First Middle Last </div> | | |
| Date _____ Birth date _____ Age _____ | | | Sex: <input type="checkbox"/> Female <input type="checkbox"/> Male | | |
| School _____ Grade _____ | | | Relationship to child: | | |
| Sex: <input type="checkbox"/> Female <input type="checkbox"/> Male Other data _____ | | | <input type="checkbox"/> Mother <input type="checkbox"/> Father <input type="checkbox"/> Guardian <input type="checkbox"/> Other _____ | | |

| | |
|---|--|
| <ol style="list-style-type: none"> 1. Adjusts well to new teachers. N S O A 2. Threatens to hurt others. N S O A 3. Worries. N S O A 4. Listens to directions. N S O A 5. Rocks back and forth for long periods of time. N S O A 6. Runs away from home. N S O A 7. Says, "I don't have any friends." N S O A 8. Cannot wait to take turn. N S O A 9. Attends after-school activities. N S O A 10. Says, "please" and "thank you." N S O A 11. Complains of shortness of breath. N S O A 12. Readily starts up conversations with new people. N S O A 13. Plays with fire. N S O A 14. "Shows off." N S O A 15. Is too serious. N S O A 16. Wets bed. N S O A 17. Tries to hurt self. N S O A 18. Has friends who are in trouble. N S O A 19. Says, "I want to kill myself." N S O A 20. Leaves seat during meals. N S O A 21. Joins clubs or social groups. N S O A 22. Encourages others to do their best. N S O A 23. Complains of dizziness. N S O A 24. Will change direction to avoid having to greet someone. N S O A 25. Dares other children to do things. N S O A 26. Stutters. N S O A 27. Says, "I'm afraid I'll hurt someone." N S O A 28. Is in trouble with the police. N S O A 29. Cries easily. N S O A 30. Throws tantrums. N S O A 31. Uses medication. N S O A 32. Congratulates others when good things happen to them. N S O A 33. Complains of being cold. N S O A 34. Hits other children. N S O A 35. Has eye problems. N S O A | <ol style="list-style-type: none"> 36. Is easily soothed when angry. N S O A 37. Teases others. N S O A 38. Worries about what parents think. N S O A 39. Forgets things. N S O A 40. Repeats one activity over and over. N S O A 41. Uses foul language. N S O A 42. Says, "Nobody understands me." N S O A 43. Needs too much supervision. N S O A 44. Is a "self-starter." N S O A 45. Has a sense of humor. N S O A 46. Complains of pain. N S O A 47. Avoids competing with other children. N S O A 48. Gets upset when plans are changed. N S O A 49. Argues with parents. N S O A 50. Says, "I get nervous during tests" or "Tests make me nervous." N S O A 51. Is easily distracted. N S O A 52. Picks at things like own hair, nails, or clothing. N S O A 53. Shows a lack of concern for others' feelings. N S O A 54. Is easily frustrated. N S O A 55. Is restless during movies. N S O A 56. Has lots of ideas. N S O A 57. Volunteers to help with things. N S O A 58. Vomits. N S O A 59. Is shy with other children. N S O A 60. Is a "sore loser." N S O A 61. Tries too hard to please others. N S O A 62. Daydreams. N S O A 63. Has to stay after school for punishment. N S O A 64. Is easily upset. N S O A 65. Fiddles with things while at meals. N S O A 66. Is good at getting people to work together. N S O A 67. Uses appropriate table manners. N S O A 68. Has ear infections. N S O A 69. Has toileting accidents. N S O A 70. Makes frequent visits to the doctor. N S O A |
|---|--|

Indicate how frequently each behavior occurs by circling
N — Never S — Sometimes O — Often A — Almost always

| | | | |
|---|---------|---|---------|
| 71. Adjusts well to changes in routine. | N S O A | 105. Is a "good sport." | N S O A |
| 72. Is critical of others. | N S O A | 106. Calls other children names. | N S O A |
| 73. Is afraid of dying. | N S O A | 107. Says, "I'm afraid I will make a mistake." | N S O A |
| 74. Gives up easily when learning something new. | N S O A | 108. Completes work on time. | N S O A |
| 75. Seems out of touch with reality. | N S O A | 109. Plays in toilet. | N S O A |
| 76. Lies to get out of trouble. | N S O A | 110. Has been suspended from school. | N S O A |
| 77. Complains about not having friends. | N S O A | 111. Says, "Nobody likes me." | N S O A |
| 78. Interrupts others when they are speaking. | N S O A | 112. Makes loud noises when playing. | N S O A |
| 79. Is creative. | N S O A | 113. Will speak up if the situation calls for it. | N S O A |
| 80. Makes suggestions without offending others. | N S O A | 114. Responds when spoken to. | N S O A |
| 81. Has headaches. | N S O A | 115. Has difficulty breathing. | N S O A |
| 82. Refuses to join group activities. | N S O A | 116. Avoids other children. | N S O A |
| 83. Shares toys or possessions with other children. | N S O A | 117. Adjusts well to changes in family plans. | N S O A |
| 84. Complains about rules. | N S O A | 118. Argues when denied own way. | N S O A |
| 85. Worries about things that cannot be changed. | N S O A | 119. Says, "I'm not very good at this." | N S O A |
| 86. Completes homework from start to finish without taking a break. | N S O A | 120. Listens attentively. | N S O A |
| 87. Eats things that are not food. | N S O A | 121. Hears sounds that are not there. | N S O A |
| 88. Gets into trouble in the neighborhood. | N S O A | 122. Lies. | N S O A |
| 89. Changes mood quickly. | N S O A | 123. Is sad. | N S O A |
| 90. Is overly active. | N S O A | 124. Climbs on things. | N S O A |
| 91. Gives good suggestions for solving problems. | N S O A | 125. Makes decisions easily. | N S O A |
| 92. Politely asks for help. | N S O A | 126. Tries to bring out the best in other people. | N S O A |
| 93. Has allergic reactions. | N S O A | 127. Complains of heart beating too fast. | N S O A |
| 94. Shows fear of strangers. | N S O A | 128. Clings to parent in strange surroundings. | N S O A |
| 95. Breaks other children's things. | N S O A | 129. Is cruel to animals. | N S O A |
| 96. Worries about what teachers think. | N S O A | 130. Worries about schoolwork. | N S O A |
| 97. Complains about being unable to block out unwanted thoughts. | N S O A | 131. Sees things that are not there. | N S O A |
| 98. Gets in trouble. | N S O A | 132. Sleeps with parents. | N S O A |
| 99. Says, "I want to die" or "I wish I were dead." | N S O A | 133. Says, "I'm so ugly." | N S O A |
| 100. Has seizures. | N S O A | 134. Has a hearing problem. | N S O A |
| 101. Is usually chosen as a leader. | N S O A | 135. Is energetic. | N S O A |
| 102. Compliments others. | N S O A | 136. Shows interest in others' ideas. | N S O A |
| 103. Gets sick. | N S O A | 137. Has stomach problems. | N S O A |
| 104. Begins conversations appropriately. | N S O A | 138. Offers help to other children. | N S O A |

Hare Self Esteem Scale

Hare Scale

Peer Scale

In the blank provided, please write the letter of the answer that best describes how you feel about the sentence. These sentences are designed to find out how you generally feel when you are with other people your age. There are no right or wrong answers.

A = Strongly Agree
B = Agree
C = Disagree
D = Strongly Disagree

- ___ 1. I have at least as many friends as other people my age.
- ___ 2. I am *not* as popular as other people my age.
- ___ 3. In the kinds of things that people my age like to do, I am at least as good as most other people.
- ___ 4. People my age often pick on me.
- ___ 5. Other people think I am a lot of fun to be with.
- ___ 6. I usually keep to myself because I am *not* like other people my age.
- ___ 7. Other people wish that they were like me.
- ___ 8. I wish I were a different kind of person because I'd have more friends.
- ___ 9. If my group of friends decided to vote for leaders of their group I'd be elected to a high position.
- ___ 10. When things get tough, I am not a person that other people my age would turn to for help.

Home Scale

In the blank provided, please write the letter of the answer that best describes how you feel about the sentence. These sentences are designed to find out how you generally feel when you are with your family. There are no right or wrong answers.

A = Strongly Agree
B = Agree
C = Disagree
D = Strongly Disagree

- ____ 1. My parents are proud of the kind of person I am.
- ____ 2. No one pays much attention to me at home.
- ____ 3. My parents feel that I can be depended on.
- ____ 4. I often feel that if they could, my parents would trade me in for another child.
- ____ 5. My parents try to understand me.
- ____ 6. My parents expect too much of me.
- ____ 7. I am an important person to my family.
- ____ 8. I often feel unwanted at home.
- ____ 9. My parents believe that I will be a success in the future.
- ____ 10. I often wish that I had been born into another family.

School Scale

In the blank provided, please write the letter of the answer that best describes how you feel about the sentence. These sentences are designed to find out how you generally feel when you are in school. There are no right or wrong answers.

A = Strongly Agree
B = Agree
C = Disagree
D = Strongly Disagree

- ____ 1. My teachers expect too much of me.
- ____ 2. In the kinds of things we do in school, I am at least as good as other people in my class.
- ____ 3. I often feel worthless in school.
- ____ 4. I am usually proud of my report card.
- ____ 5. School is harder for me than most other people.
- ____ 6. My teachers are usually happy with the kind of work I do.
- ____ 7. Most of my teachers do *not* understand me.
- ____ 8. I am an important person in my class.
- ____ 9. It seems that no matter how hard I try, I never get the grades I deserve.
- ____ 10. All and all, I feel I've been very fortunate to have had the kinds of teachers I've had since I started school.

Appendix C

Contextual Psychosocial Measures

FES

There are 27 statements about families. You are to decide which of these statements are true about your family and which are false. If you think the statement is FALSE or MOSTLY FALSE of your family, check FALSE.

You may feel that some of the statements are true for some family members and false for others. Mark TRUE if the statement is TRUE for most members. Mark FALSE if the statement is FALSE for most members. If members are evenly divided, decide what is the stronger overall impression and answer accordingly.

Remember, we would like to know what your family seems like to you. So do not try to figure out how other members see your family, but do give us your general impression of your family for each statement.

| TRUE | FALSE | |
|-------|-------|--|
| _____ | _____ | 1. Family members really help and support one another. |
| _____ | _____ | 2. Family members often keep their feelings to themselves. |
| _____ | _____ | 3. We fight a lot in our family. |
| _____ | _____ | 4. We often seem to be killing time at home. |
| _____ | _____ | 5. We say anything we want to around home. |
| _____ | _____ | 6. Family members rarely become openly angry. |
| _____ | _____ | 7. We put a lot of energy into what we do at home. |
| _____ | _____ | 8. It's hard to "blow off steam" at home without upsetting somebody. |
| _____ | _____ | 9. Family members sometimes get so angry they throw things. |
| _____ | _____ | 10. There is a feeling of togetherness in our family. |
| _____ | _____ | 11. We tell each other about our personal problems. |
| _____ | _____ | 12. Family members hardly ever lose their tempers. |

Parental Stress Index

1. When my child wants something, my child usually keeps trying to get it.
2. My child is so active that it exhausts me.
3. My child appears disorganized and is easily distracted.
4. Compared to most, my child has more difficulty concentrating and paying attention.
5. My child will often stay occupied with a toy for more than 10 minutes.
6. My child wanders away much more than I expected.
7. My child is much more active than I expected.
8. My child squirms and kicks a great deal when being dressed or bathed.
9. My child can be easily distracted from wanting something.
10. My child rarely does things for me that make me feel good.
11. Most times I feel that my child likes me and wants to be close to me.
12. Sometimes I feel my child doesn't like me and doesn't want to be close to me.
13. My child smiles at me much less than I expected.
14. When I do things for my child, I get the feeling that my efforts are not appreciated very much.

For statement 15, choose a response from choices 1 to 4 below.

15. Which statement best describes your child?
 1. almost always likes to play with me
 2. sometimes likes to play with me
 3. usually doesn't like to play with me
 4. almost never likes to play with me

For statement 16, choose a response from choices 1 to 5 below.

16. My child cries and fusses:
 1. much less than I had expected
 2. less than I expected
 3. about as much as I expected
 4. much more than I expected
 5. it seems almost constant
17. My child seems to cry or fuss more often than most children.
18. When playing, my child doesn't often giggle or laugh.
19. My child generally wakes up in a bad mood.
20. I feel that my child is very moody and easily upset.
21. My child looks a little different than I expected and it bothers me at times.
22. In some areas, my child seems to have forgotten past learnings and has gone back to doing things characteristic of younger children.
23. My child doesn't seem to learn as quickly as most children.
24. My child doesn't seem to smile as much as most children.

25. My child does a few things which bother me a great deal.
26. My child is not able to do as much as I expected.
27. My child does not like to be cuddled or touched very much.
28. When my child came home from the hospital, I had doubtful feelings about my ability to handle being a parent.
29. Being a parent is harder than I thought it would be.
30. I feel capable and on top of things when I am caring for my child.
31. Compared to the average child, my child has a great deal of difficulty in getting used to changes in schedules or changes around the house.
32. My child reacts very strongly when something happens that my child doesn't like.
33. Leaving my child with a babysitter is usually a problem.
34. My child gets upset easily over the smallest thing.
35. My child easily notices and overreacts to loud sounds and bright lights.
36. My child's sleeping or eating schedule was much harder to establish than I expected.
37. My child usually avoids a new toy for a while before beginning to play with it.
38. It takes a long time and it is very hard for my child to get used to new things.
39. My child doesn't seem comfortable when meeting strangers.

For statement 40, choose from choices 1 to 4 below.

40. When upset, my child is:
 1. easy to calm down
 2. harder to calm down than I expected
 3. very difficult to calm down
 4. nothing I do helps to calm my child

For statement 41, choose from choices 1 to 5 below.

41. I have found that getting my child to do something or stop doing something is:
 1. much harder than I expected
 2. somewhat harder than I expected
 3. about as hard as I expected
 4. somewhat easier than I expected
 5. much easier than I expected

For statement 42, choose from choices 1 to 5 below.

42. Think carefully and count the number of things which your child does that bothers you. For example: dawdles, refuses to listen, overactive, cries, interrupts, fights, whines, etc. Please circle the number which includes the number of things you counted.
 1. 1-3
 2. 4-5
 3. 6-7
 4. 8-9
 5. 10+

For statement 43, choose from choices 1 to 5 below.

43. When my child cries, it usually lasts:
1. less than 2 minutes
 2. 2-5 minutes
 3. 5-10 minutes
 4. 10-15 minutes
 5. more than 15 minutes
44. There are some things my child does that really bother me a lot.
45. My child has had more health problems than I expected.
46. As my child has grown older and become more independent, I find myself more worried that my child will get hurt or into trouble.
47. My child turned out to be more of a problem than I had expected.
48. My child seems to be much harder to care for than most.
49. My child is always hanging on me.
50. My child makes more demands on me than most children.
51. I can't make decisions without help.
52. I have had many more problems raising children than I expected.
53. I enjoy being a parent.
54. I feel that I am successful most of the time when I try to get my child to do or not do something.
55. Since I brought my last child home from the hospital, I find that I am not able to take care of this child as well as I thought I could. I need help.
56. I often have the feeling that I cannot handle things very well.

For statement 57, choose from choices 1 to 5 below.

57. When I think about myself as a parent I believe:
1. I can handle anything that happens
 2. I can handle most things pretty well
 3. sometimes I have doubts, but find that I handle most things without any problems
 4. I have some doubts about being able to handle things
 5. I don't think I handle things very well at all

For statement 58, choose from choices 1 to 5 below.

58. I feel that I am:
1. a very good parent
 2. a better than average parent
 3. an average parent
 4. a person who has some trouble being a parent
 5. not very good at being a parent

For questions 59 and 60, choose from choices 1 to 5 below.

59. What were the highest levels in school or college you and the child's father/mother have completed?
Mother:
1. 1st to 8th grade
 2. 9th to 12th grade
 3. vocational or some college
 4. college graduate
 5. graduate or professional school
60. Father:
1. 1st to 8th grade
 2. 9th to 12th grade
 3. vocational or some college
 4. college graduate
 5. graduate or professional school

For question 61, choose from choices 1 to 5 below.

61. How easy is it for you to understand what your child wants or needs?
1. very easy
 2. easy
 3. somewhat difficult
 4. it is very hard
 5. I usually can't figure out what the problem is
62. It takes a long time for parents to develop close, warm feelings for their children.
63. I expected to have closer and warmer feelings for my child than I do and this bothers me.
64. Sometimes my child does things that bother me just to be mean.
65. When I was young, I never felt comfortable holding or taking care of children.
66. My child knows I am his or her parent and wants me more than other people.
67. The number of children that I have now is too many.
68. Most of my life is spent doing things for my child.
69. I find myself giving up more of my life to meet my children's needs than I ever expected.
70. I feel trapped by my responsibilities as a parent.
71. I often feel that my child's needs control my life.
72. Since having this child, I have been unable to do new and different things.
73. Since having a child, I feel that I am almost never able to do things that I like to do.
74. It is hard to find a place in our home where I can go to be by myself.
75. When I think about the kind of parent I am, I often feel guilty or bad about myself.
76. I am unhappy with the last purchase of clothing I made for myself.
77. When my child misbehaves or fusses too much, I feel responsible, as if I didn't do something right.
78. I feel every time my child does something wrong, it is really my fault.

79. I often feel guilty about the way I feel toward my child.
80. There are quite a few things that bother me about my life.
81. I felt sadder and more depressed than I expected after leaving the hospital with my baby.
82. I wind up feeling guilty when I get angry at my child and this bothers me.
83. After my child had been home from the hospital for about a month, I noticed that I was feeling more sad and depressed than I had expected.
84. Since having my child, my spouse (or male/female friend) has not given me as much help and support as I expected.
85. Having a child has caused more problems than I expected in my relationship with my spouse (or male/female friend).
86. Since having a child, my spouse (or male/female friend) and I don't do as many things together.
87. Since having a child, my spouse (or male/female friend) and I don't spend as much time together as a family as I had expected.
88. Since having my last child, I have had less interest in sex.
89. Having a child seems to have increased the number of problems we have with in-laws and relatives.
90. Having children has been much more expensive than I had expected.
91. I feel alone and without friends.
92. When I go to a party, I usually expect not to enjoy myself.
93. I am not as interested in people as I used to be.
94. I often have the feeling that other people my own age don't particularly like my company.
95. When I run into a problem taking care of my children, I have a lot of people to whom I can talk to get help or advice.
96. Since having children, I have a lot fewer chances to see my friends and to make new friends.
97. During the past six months, I have been sicker than usual or have had more aches and pains than I normally do.
98. Physically, I feel good most of the time.
99. Having a child has caused changes in the way I sleep.
100. I don't enjoy things as I used to.

For statement 101, choose from choices 1 to 4 below.

101. Since I've had my child:
 1. I have been sick a great deal
 2. I haven't felt as good
 3. I haven't noticed any change in my health
 4. I have been healthier

For statements 102 to 120, choose from choices Y for "Yes" and N for "No."

During the last 12 months, have any of the following events occurred in your immediate family?

- 102. Divorce
- 103. Marital reconciliation
- 104. Marriage
- 105. Separation
- 106. Pregnancy
- 107. Other relative moved into household
- 108. Income increased substantially (20% or more)
- 109. Went deeply into debt
- 110. Moved to new location
- 111. Promotion at work
- 112. Income decreased substantially
- 113. Alcohol or drug problem
- 114. Death of close family friend
- 115. Began new job
- 116. Entered new school
- 117. Trouble with superiors at work
- 118. Trouble with teachers at school
- 119. Legal problems
- 120. Death of immediate family member

APPENDIX D

Walter Reed Army Medical Center Institutional Review Board Approval Letter



REF ID:
ATTENTION OF:

MCBL-CI

DEPARTMENT OF THE ARMY
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

24 March 2005

MEMORANDUM FOR LTC Thomas R. Burklow, MC, Department of Pediatrics
Walter Reed Army Medical Center, Washington, DC 20307-5001

SUBJECT: Approval to Begin Protocol Work Unit# 05-65009: Biobehavioral Factors in Children with Congenital Heart Disease

1. Congratulations! Your protocol was approved with revisions by the Clinical Investigation Committee (CIC) on 16 November 2004 and by the Human Use Committee (HUC) on 11 January 2005 as a "minimal risk" human use protocol. Please use the assigned seven (7) digits Work Unit# 05-65009 for all correspondence with Department of Clinical Investigation (DCI) regarding this study as noted on item 4 below.
2. The last of the required revisions were received on 22 March 2005. A copy of the minutes from the applicable committee (s) and a final copy of the approved research protocol are attached for your administrative files. Also, enclosed are the approved stamped consent form that must be duplicated and used for enrolling subjects, and the "STEP-BY-STEP GUIDE..." to be used when consenting subjects. You may begin work on the project upon receipt of this letter. Your research protocol was approved for an enrollment of up to 200 subjects (100 children and 100 parents) at Walter Reed. This approval is only for ~~one~~ year. As part of your continuing review and re-approval and in order to keep your research ongoing, you are required to submit an annual progress report (APR) in the first week of December each year.
3. No funding has been approved for this study.
4. As the principal investigator (PI), you are required by Federal, DoD, and WRAMC regulations to submit the following in a timely fashion to the Department of Clinical Investigation if applicable: (a) addenda delineating any changes in the protocol, (b) PI change, (c) notification of serious or unexpected adverse effects within 24 hours, and (d) publication clearance, travel orders and funding requests.
5. Also enclosed, is a copy of the WRAMC Federal Wide Assurance (FWA) that all investigators agree to adhere to in conducting research, as attested to by your submission of a signed Principal Investigator Responsibilities Statement. If you have any questions, the POC is Kendra Hill at (202) 782-7841.

4 Encls
as


SUSAN D. FRACISCO
LTC, MC
Chief, Research Review Service
Asst Chief, Department of Clinical Investigation

CF: Research Administration Service

Uniform Services University of the Health Sciences Institutional Review Board Approval Letter



UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799



July 14, 2009

MEMORANDUM FOR LT ANGELIQUE DEMONCADA, MSCP, MS, MEDICAL AND CLINICAL
PSYCHOLOGY, STUDENT RESEARCHER

SUBJECT: Acceptance of Walter Reed Army Medical Center Human Subjects Research Protocol 05-65009,
USU Grant Number T072LH.

In accordance with USUHS-WRAMC IRB Authorization Agreement, the Uniformed Services University IRB (DoD Assurance No. P60001 and FWA #0001628) accepts the Initial Review of the research protocol entitled, "*Biobehavioral Factors in Children with Congenital Heart Disease*," approved by the Walter Reed Army Medical Center Institutional Review Board on Tuesday, February 24, 2009. This is a No More Than Minimal Risk protocol. The Uniformed Services University date of acceptance for this action is Tuesday, July 14, 2009. This approval will be reported to the full Uniformed Services University IRB scheduled to meet on Thursday, August 13, 2009.

The purpose of this study is to examine the role of altered family environment and individual characteristics in quality of life and autonomic nervous system responses to every day activities among children with Congenital Heart Disease (CHD).

This study is open for data analysis only.

To maintain USU authorization to participate in this protocol, you are required to submit copies of all approval documentation from external IRBs to the USU IRB Office within 30 days of your receipt of these materials. Documents that must be forwarded to the USU IRB include all approval letters, a copy of stamped, final informed consent documents (if applicable), amendments to this protocol, changes to the informed consent document (if applicable), adverse event reports, and other information pertinent to human research. Continuing (annual) review documentation must be accompanied by a current USU Form 3204B.

If you have questions regarding this IRB action, or questions of a more general nature concerning human participation in research, please contact the undersigned at rachael.wolf@usuhs.mil or (301) 295-0814.

Rachael Wolf, M.B.A., M.S.
Institutional Review Coordinator

cc: VPR/OSP
Chair, MPS

File

Appendix E Parental Consent Form

Combined CF

Page 1 of 5

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25 or AR 40-38; the proponent agency is OTSG

PRIVACY ACT OF 1974

Authority: 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087.

Principle Purpose: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; adjudication of claims; and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you. If future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A(1) - VOLUNTEER AFFIDAVIT

Volunteer Subjects in Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____, SSN _____, having full capacity to consent and having attained my _____ birthday, do hereby volunteer/give consent as legal representative for _____ to participate in _____

Behavioral Factors in children with Congenital Heart Disease

under the direction of LTC Thomas R. Burklow, MC, Chief, Department of Pediatrics, 202-782-6248

conducted at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name of Institution)

The implications of my voluntary participation/consent as legal representative; duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

LTC Thomas R. Burklow, or his designee, Department of Pediatrics, 202-782-6248

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights/the rights of the person I represent on study-related injury, I may contact

CENTER JUDGE ADVOCATE OFFICE - (202) 782-1550 OR DSN 662-1550

at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name, Address and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my consent and withdraw/have the person I represent withdrawn from the study without further penalty or loss of benefits; however, I/the person I represent may be required (military volunteer) or requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my/the person I represent's health and well-being. My/the person I represent's refusal to participate will involve no penalty or loss of benefits to which I/the person I represent is otherwise entitled.

LIMITATIONS TO MEDICAL CARE ARE DESCRIBED IN PART B

PART A (2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD)

I, _____, SSN _____, having full capacity to assent and having attained my _____ birthday, do hereby volunteer for _____ to participate in _____

under the direction of

Conducted at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name of Institution
(Continue on Reverse))

Approved by the WRAMC HUC/IRB on 1/10/05 HUC Initials KH
This form expires on 1/10/06



PART A(2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD) (Cont'd)

The implications of my voluntary participation; the nature, duration, and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights I may contact

CENTER JUDGE ADVOCATE OFFICE - (202) 782-1550 OR DSN 662-1550

at **WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001**
(Name, Address, and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my assent and withdraw from the study without further penalty or loss of benefits; however, I may be requested to undergo certain examinations if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

LIMITATIONS TO MEDICAL CARE ARE DESCRIBED IN PART B

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix C, AR 40-38 or AR 70-25)

DESCRIPTION OF THIS STUDY

You and your child are being asked to be in this research study because your child has Congenital Heart Disease (CHD). You/your child's participation is entirely voluntary. Eligibility requires the participation of both you and your child. If you/your child do not want to be a part of this study, there will be no penalty or loss of any benefits to which you/your child are otherwise entitled.

There are two main aims of this study. The first aim is to look at the link between the family environment of children with CHD and their quality of life and how their heart works. The second aim is to look at the link between the behavior of children with CHD and their quality of life and how their heart works.

Studies with healthy children have shown that what happens in a child's home affects how the child's heart works, including blood pressure and heart rate. Also, how the child behaves can affect how the child's heart works. It is not known whether heart rate variability is mostly affected by daily life hassles (stress) or the child's heart function. Studies have found that changes in how the heart functions in childhood can affect the heart's functioning later in life.

If you and your child agree to be in this study, you will be asked to fill out 4 questionnaires. These questionnaires will ask about your family environment, your perceived level of stress, your child's behavior, and your child's quality of life.

I do ☐ do not ☐ (check one & initial) consent to the inclusion of this form in my outpatient medical treatment record.

| | | | |
|--------------------------------|-----------------------|---|--|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor) | |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | | |
| | Not Applicable | | |
| | SIGNATURE OF WITNESS | DATE | |

REVERSE OF DA FORM 5303-R, MAY 89

Approved by the WRAMC HUC/IRB on 1/11/05 HUC
This form expires on 1/10/06 Initials KH
for WU # 05-65009

PART B - TO BE COMPLETED BY INVESTIGATOR (Cont'd)

If you and your child agree to be in this study, your child will be asked to wear two monitors while completing four tasks. The tasks include a computer game, a mirror-trace task, an age-appropriate math task, and applying a cold cloth to your child's forehead. Each task will last no longer than 5 minutes, with at least a 5-minute rest period between each task. The monitors will be measuring heart rate, blood pressure, and cardiac output. During the study, a pediatric cardiologist will be present to monitor all heart rate readings and ensure the safety of your child. After completing the four tasks, the monitors will be removed and your child will be asked to complete 3 questionnaires. These questionnaires will ask about your child's quality of life, your child's behavior, and your child's self-esteem. Questionnaires will be read aloud to children who are unable to read. Help will be provided regarding content of the questions, as necessary. Then, we ask your child to wear a special wristwatch. This watch is made to measure activity levels during usual daily life activities. You have been given a special FedEx envelope to send the watch back to the hospital after it has been worn as instructed for 5 days.

AMOUNT OF TIME FOR YOU TO COMPLETE THIS STUDY

You will be part of this study for a total of 1 day. During this time, you will be asked to visit the clinic with your child one time for about 2 hours.

Your child will be part of this study for a total of 5 days. During this time, your child will be asked to visit the clinic one time for about 2 hours. After that visit, we ask your child to wear a special watch that measures activity levels for the next 5 days.

APPROXIMATE NUMBER OF PEOPLE TAKING PART IN THIS STUDY

There will be a total of up to 100 children and 100 parents taking part in this study.

POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

There are minimal risks and discomforts from being in this study.

POSSIBLE BENEFITS OF BEING IN THIS STUDY

There are possible benefits to you from being in this study. Another possible benefit is that how well your child's heart functions during daily activities will be known. Also, this study will provide an actual assessment of how your child's heart disease is affecting his/her quality of life. If a specific problem is identified, a referral to an appropriate mental health professional will be provided. However, no benefit can be guaranteed.

| | | |
|--------------------------------|-----------------------|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | |
| | Not Applicable | |
| | SIGNATURE OF WITNESS | DATE |

REVERSE OF DA FORM 5303-R, MAY 89

Approved by the WRAMC HUC/IRB on 1/11/05 HUC for WU # 05-65009
This form expires on 1/10/06 Initials RA



PART B - TO BE COMPLETED BY INVESTIGATOR (Cont'd)

CONFIDENTIALITY (PRIVACY) OF YOUR IDENTITY AND RESEARCH RECORDS

The principal investigator will keep records of your participation in this study. These records may be looked at by people from the Walter Reed Department of Clinical Investigation, the Walter Reed Human Use Committee, the Army Clinical Investigation Regulatory Office (CIRO), and other government agencies as part of their duties. These duties include making sure that research subjects are protected. Confidentiality of your records will be protected to the extent possible under existing regulations and laws. You will be provided with a participant number. Any identifying information will be kept in a locked filing cabinet in the principal investigator's office. Your name will not appear in any published paper or presentation related to this study.

CONDITIONS UNDER WHICH YOUR TAKING PART IN THIS STUDY MAY BE STOPPED WITHOUT YOUR CONSENT

Your/your child's participation in this study may be stopped without your consent if remaining in the study might be dangerous or harmful to you or your child. Your/your child's participation in this study may also be stopped without your consent if the military mission requires it, or if you become ineligible for medical care at military hospitals.

ELIGIBILITY AND PAYMENT FOR BEING IN THIS STUDY

Your child will receive a certificate for his/her participation in this study. You will not receive any form of payment for being in this study.

COMPENSATION TO YOU IF INJURED AND LIMITS TO YOUR MEDICAL CARE

Should you or your child be injured as a direct result of being in this study, you/your child will be provided medical care for that injury at no cost to you. You/your child will not receive any compensation (payment) for injury. You should also understand that this is not a waiver or release of your/your child's legal rights. You should discuss this issue thoroughly with the principal investigator before you enroll in this study.

Medical care is limited to the care normally allowed for Department of Defense health care beneficiaries (patients eligible for care at military hospitals and clinics). Necessary medical care does not include in-home care or nursing home care.

| | | |
|--------------------------------|-----------------------|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | |
| | SIGNATURE OF WITNESS | DATE |

REVERSE OF DA FORM 5303-R, MAY 89

Approved by the WRAMC HUC/IRB on 11/10/06
 This form expires on 11/10/06
 Initials HUC RH



PART B - TO BE COMPLETED BY INVESTIGATOR (Cont'd)

WHAT WILL HAPPEN IF YOU DECIDE TO STOP TAKING PART IN THIS STUDY AND INSTRUCTIONS FOR STOPPING EARLY

You or your child have the right to withdraw from this study at any time. If you/ your child decide to stop taking part in this study, you should tell the principal investigator as soon as possible. By leaving this study at any time, you in no way risk losing your/your child's right to medical care.

Please feel free to ask any questions that will allow you to clearly understand this study.
A copy of this consent form will be provided to you.

Approved by the WRAMC HUC/IRB on 11/05/06 for WU # 05-65009
This form expires on 11/05/06 Initials HUC KH



| | | |
|--------------------------------|--|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS <i>Not applicable</i> | |
| | SIGNATURE OF WITNESS | DATE |

REVERSE OF DA FORM 5303-R, MAY 89

Child Assent Form

2664_05-65009 Combined CF 14 Feb 06 to 11 Jan 07

Page 1 of 4

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25 or AR 40-38; the proponent agency is OTSG

PRIVACY ACT OF 1974

Authority: 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087.

Principle Purpose: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; adjudication of claims; and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you. If future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A(1) - VOLUNTEER AFFIDAVIT

Volunteer Subjects in Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____, SSN _____
having full capacity to consent and having attained my _____ birthday, do hereby volunteer/give consent as legal
representative for _____ to participate in _____

Biobehavioral Factors in Children with Congenital Heart Disease

under the direction of COL Thomas R. Burklow, MC, Chief, Department of Pediatrics, 202-782-6248

conducted at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name of Institution)

The implications of my voluntary participation/consent as legal representative; duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

COL Thomas R. Burklow MC, or his designee, Department of Pediatrics, 202-782-6248

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights/the rights of the person I represent on study-related injury, I may contact

CENTER JUDGE ADVOCATE OFFICE - (202) 782-1550 OR DSN 662-1550

at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name, Address and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my consent and withdraw/have the person I represent withdrawn from the study without further penalty or loss of benefits; however, I/the person I represent may be required (military volunteer) or requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my/the person I represent's health and well-being. My/the person I represent's refusal to participate will involve no penalty or loss of benefits to which I/the person I represent is otherwise entitled.

LIMITATIONS TO MEDICAL CARE ARE DESCRIBED IN PART B

PART A (2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD)

I, _____, SSN _____, having full capacity
to assent and having attained my _____ birthday, do hereby volunteer for _____
to participate in _____

under the direction of _____

Conducted at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001

(Name of Institution)
(Continue on Reverse)

Approved by the WRAMC HUC/IRB on 17 Feb 06 (APB) Initials
This form expires on 11 Jan 07

PART A(2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD) (Cont'd)

The implications of my voluntary participation; the nature, duration, and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights I may contact

CENTER JUDGE ADVOCATE OFFICE - (202) 782-1550 OR DSN 662-1550

at WALTER REED ARMY MEDICAL CENTER, WASHINGTON, DC 20307-5001
(Name, Address, and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my assent and withdraw from the study without further penalty or loss of benefits; however, I may be requested to undergo certain examinations if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

LIMITATIONS TO MEDICAL CARE ARE DESCRIBED IN PART B

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix C, AR 40-38 or AR 70-25)

DESCRIPTION OF THIS STUDY

You and your child are being asked to be in this research study because your child has Congenital Heart Disease (CHD). You/your child's participation is entirely voluntary. Eligibility requires the participation of both you and your child. If you/your child do not want to be a part of this study, there will be no penalty or loss of any benefits to which you/your child are otherwise entitled.

There are two main aims of this study. The first aim is to look at the link between the family environment of children with CHD and their quality of life and how their heart works. The second aim is to look at the link between the behavior of children with CHD and their quality of life and how their heart works.

Studies with healthy children have shown that what happens in a child's home affects how the child's heart works, including blood pressure and heart rate. Also, how the child behaves can affect how the child's heart works. It is not known whether heart rate variability is mostly affected by daily life hassles (stress) or the child's heart function. Studies have found that changes in how the heart functions in childhood can affect the heart's functioning later in life.

If you and your child agree to be in this study, you will be asked to fill out 4 questionnaires. These questionnaires will ask about your family environment, your perceived level of stress, your child's behavior, and your child's quality of life.

If you and your child agree to be in this study, your child will be asked to wear two monitors while completing four tasks. The tasks include a computer game, a mirror-trace task, an age-appropriate math task,

I do ☐ do not ☐ (check one & initial) consent to the inclusion of this form in my outpatient medical treatment record.

| | | |
|--------------------------------|-----------------------|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | |
| | SIGNATURE OF WITNESS | |

NOT APPLICABLE

REVERSE OF DA FORM 5303-R, MAY 89

for WTU # 05-65009
Approved by the WRAMC HUC/IRB on 11 Feb 07
Initials

PART B - TO BE COMPLETED BY INVESTIGATOR (Cont'd)

and applying a cold cloth to your child's forehead. Each task will last no longer than 5 minutes, with at least a 5-minute rest period between each task. The monitors will be measuring heart rate, blood pressure, and cardiac output. During the study, a pediatric cardiologist will be present to monitor all heart rate readings and ensure the safety of your child. After completing the four tasks, the monitors will be removed and your child will be asked to complete 3 questionnaires. These questionnaires will ask about your child's quality of life, your child's behavior, and your child's self-esteem. Questionnaires will be read aloud to children who are unable to read. Help will be provided regarding content of the questions, as necessary. Then, we ask your child to wear a special wristwatch. This watch is made to measure activity levels during usual daily life activities. You have been given a special FedEx envelope to send the watch back to the hospital after it has been worn as instructed for 5 days.

AMOUNT OF TIME FOR YOU TO COMPLETE THIS STUDY

You will be part of this study for a total of 1 day. During this time, you will be asked to visit the clinic with your child one time for about 2 hours.

Your child will be part of this study for a total of 5 days. During this time, your child will be asked to visit the clinic one time for about 2 hours. After that visit, we ask your child to wear a special watch that measures activity levels for the next 5 days.

APPROXIMATE NUMBER OF PEOPLE TAKING PART IN THIS STUDY

There will be a total of up to 100 children and 100 parents taking part in this study.

POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

There are minimal risks and discomforts from being in this study.

POSSIBLE BENEFITS OF BEING IN THIS STUDY

There are possible benefits to you from being in this study. Another possible benefit is that how well your child's heart functions during daily activities will be known. Also, this study will provide an actual assessment of how your child's heart disease is affecting his/her quality of life. If a specific problem is identified, a referral to an appropriate mental health professional will be provided. However, no benefit can be guaranteed.

CONFIDENTIALITY (PRIVACY) OF YOUR IDENTITY AND RESEARCH RECORDS

The principal investigator will keep records of your participation in this study. These records may be looked at by people from the Walter Reed Department of Clinical Investigation, the Walter Reed Human Use Committee, the Army Clinical Investigation Regulatory Office (CIRO), and other government agencies as part of their duties. These duties include making sure that research subjects are protected. Confidentiality of your records will be protected to the extent possible under existing regulations and laws. You will be provided with a participant number. Any identifying information will be kept in a locked filing cabinet in the principal investigator's office. Your name will not appear in any published paper or presentation related to this study.

| | | |
|--------------------------------|-----------------------|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | |
| | SIGNATURE OF WITNESS | |

NOT APPLICABLE

PART B - TO BE COMPLETED BY INVESTIGATOR (Cont'd)

This research study meets the confidentiality requirements of the Health Insurance Portability and Accountability Act (HIPAA). A HIPAA Authorization Form for this study will be provided to you separately, and you will be asked to sign that form.

CONDITIONS UNDER WHICH YOUR TAKING PART IN THIS STUDY MAY BE STOPPED WITHOUT YOUR CONSENT

Your/your child's participation in this study may be stopped without your consent if remaining in the study might be dangerous or harmful to you or your child. Your/your child's participation in this study may also be stopped without your consent if the military mission requires it, or if you become ineligible for medical care at military hospitals.

ELIGIBILITY AND PAYMENT FOR BEING IN THIS STUDY

Your child will receive a certificate for his/her participation in this study. You will not receive any form of payment for being in this study.

COMPENSATION TO YOU IF INJURED AND LIMITS TO YOUR MEDICAL CARE

Should you or your child be injured as a direct result of being in this study, you/your child will be provided medical care for that injury at no cost to you. You/your child will not receive any compensation (payment) for injury. You should also understand that this is not a waiver or release of your/your child's legal rights. You should discuss this issue thoroughly with the principal investigator before you enroll in this study.

Medical care is limited to the care normally allowed for Department of Defense health care beneficiaries (patients eligible for care at military hospitals and clinics). Necessary medical care does not include in-home care or nursing home care.

WHAT WILL HAPPEN IF YOU DECIDE TO STOP TAKING PART IN THIS STUDY AND INSTRUCTIONS FOR STOPPING EARLY

You or your child has the right to withdraw from this study at any time. If you/your child decide to stop taking part in this study, you should tell the principal investigator as soon as possible. By leaving this study at any time, you in no way risk losing your/your child's right to medical care.

Please feel free to ask any questions that will allow you to clearly understand this study. A copy of this consent form will be provided to you.

| | | |
|--------------------------------|-----------------------|---|
| SIGNATURE OF VOLUNTEER | DATE | SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor) |
| PERMANENT ADDRESS OF VOLUNTEER | TYPED NAME OF WITNESS | |
| | SIGNATURE OF WITNESS | |

REVERSE OF DA FORM 5303-R, MAY 89

Approved by the WRAMC HUC/IRB on 11 Jan 07
 This form expires on 11 Jan 07
 Initials FU 06
 for WU # 05-65009